GREAT LAKES RESEARCH INSTITUTE
University of Michigan

EXPLORATION OF COLLATERAL DATA POTENTIALLY APPLICABLE TO GREAT LAKES HYDROGRAPHY AND FISHERIES

Phase I

Final Report

U. S. Fish and Wildlife Service
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1. INTRODUCTION

The Great Lakes are undoubtedly the most important single source of fresh water in the world. Their waters are utilized for numerous economic needs, such as commercial and sport fishing, power generation, municipal water supplies, industrial uses, recreation, and navigation. In line with this high degree of economic importance, the Great Lakes are now and will most likely continue to be the subjects of various scientific studies and investigations, carried out with a view toward obtaining a more lucid understanding of their physical, chemical, and biological properties and mechanisms. In conjunction with studies such as these, personnel of the Great Lakes Fisheries Investigations suggested that a great deal of limnological and meteorological information relative to the Lakes and their drainage basins would likely be available from agencies in both the United States and Canada. Likely sources would be those which routinely make use of raw lake water, such as municipal water treatment plants, disposal plants, power plants, and industries. In addition, it was believed that data might also be obtained from various governmental agencies--federal, state, and provincial. Parameters which might possibly be located were thought to include water temperature, turbidity, pH, color, and odor; chemical analyses of water; biological analyses, such as bacterial and plankton counts; water level; lake surface condition; and numerous meteorological observations, such as air temperature, precipitation, wind speed and direction, humidity, radiation, evaporation, pressure, visibility, and cloud cover.

Up to the present time little was known specifically about the availability, reliability, and extent of any data such as those enumerated above. In addition, data would likely be widely scattered and hence of little practical use to anyone interested in utilizing the contained information. It became apparent, therefore, that the location and evaluation of these collateral data should become the object of a special study.

It was proposed that the execution of such a study could best be accomplished in three phases, with the exact nature and extent of each succeeding phase governed by findings of the preceding one. Phase I would be designed to locate and determine the extent of records in the Great Lakes area that might be useful in developing a better understanding of Great Lakes hydrography. Phase II would involve a pilot study in a selected section of the Great Lakes in which all available data would be examined to determine the reliability and usefulness of the various types of records. In Phase III all records demonstrated by Phase II to be of value in hydrographic and biological studies of the Great Lakes would be accumulated over a period determined by the completeness and congruity of data, and recorded in a form suitable for easy reference and use in future studies.

Phase I was undertaken by the Great Lakes Research Institute during the past fiscal year, and is the subject of the present report.

Many persons, institutions, and agencies have been of immeasurable aid in the successful conduct of this investigation. The investigators wish to gratefully acknowledge the invaluable assistance and wholehearted cooperation of the following persons who, in various ways, were instrumental in helping locate sources of meteorological and hydrographic data: Dr. James W. Moffett, Chief, Great Lakes Fishery Investigations, U. S. Fish and Wildlife Service, Ann Arbor, Michigan; Dr. Stanford H. Smith,

Fishery Research Biologist, U. S. Fish and Wildlife Service, Ann Arbor, Michigan; Dr. Ralph Hile, Fishery Research Biologist, U. S. Fish and Wildlife Service, Ann Arbor, Michigan; Dr. Alfred M. Beeton, U. S. Fish and Wildlife Service, Ann Arbor, Michigan; James H. Johnson, Fishery Research Biologist, U. S. Fish and Wildlife Service, Ann Arbor, Michigan; Dr. D. V. Anderson, Ontario Department of Lands and Forests, Maple, Ontario; Dr. Albert Ballert, Great Lakes Commission, Ann Arbor, Michigan; N. H. Beamer, U. S. Geological Survey, Philadelphia, Pennsylvania; Dr. Albert E. Berry, General Manager, Ontario Water Resources Commission, Toronto, Ontario; Prof. Herbert M. Bosch, School of Public Health, University of Minnesota, Minneapolis, Minnesota; C. C. Boughner, Chief, Climatological Section, Department of Transport, Toronto, Ontario; A. V. DeLaporte, Director of Laboratories and Research, Ontario Water Resources Commission, Toronto, Ontario; Earl Devendorf, Director, Bureau of Environmental Sanitation, New York State Department of Health, Albany, New York; A. H. Eichmeier, State Climatologist, U. S. Weather Bureau, East Lansing, Michigan; N. G. Gray, Dominion Hydrographer, Department of Mines and Technical Surveys, Ottawa, Canada; J. R. Harvey, Regional Sanitary Engineer, Department of Health, Commonwealth of Pennsylvania, Meadville, Pennsylvania; J. H. Hubble, U. S. Geological Survey, Columbus, Ohio; Russell L. Johnson, Engineer in Charge, Michigan Department of Health, Escanaba, Michigan; Ray Joiner, Assistant to the Director, National Weather Records Center, U. S. Weather Bureau, Asheville, North Carolina; Lothar A. Joos, State Climatologist, U. S. Weather Bureau, Champaign, Illinois; Homer Knox, Principal Assistant Sanitary Engineer, State Department of Health, Columbus, Ohio; Robert Knutilla, U. S. Geological Survey, Escanaba, Michigan; W. T. Laidley, Chief Technical Assistant, U. S. Lake Survey Office, Detroit, Michigan; C. R. MacLean, Captain, U. S. Coast Guard, Chief, Operations Division, Ninth Coast Guard District, Cleveland, Ohio; Colin MacMillan, Marathon Paper Mills, Marathon, Ontario; Dr. O. J. Muegge, State Sanitary Engineer, State of Wisconsin Board of Health, Madison, Wisconsin; L. T. Pierce, State Climatologist, U. S. Weather Bureau, Columbus, Ohio; Dr. B. A. Poole, Director, Bureau of Environmental Sanitation, Indiana State Board of Health, Indianapolis, Indiana; H. W. Poston, Assistant Regional Engineer, U. S. Public Health Service, Chicago, Illinois; Jack Rademacher, Sanitary Engineer, U. S. Public Health Service, Chicago, Illinois; Lawrence A. Schaal, State Climatologist, U. S. Weather Bureau, Lafayette, Indiana; Cdr. E. O. Standish, Office of Chief of Naval Operations, U. S. Navy, Washington, D. C.; The State Climatologist, U. S. Weather Bureau, Albany, New York; Joseph H. Strub, Jr., State Climatologist, U. S. Weather Bureau, Minneapolis, Minnesota; J. F. J. Thomas, Head, Industrial Waters Section, Department of Mines and Technical Surveys, Ottawa, Ontario; Kenneth G. Tower, Regional Engineer, Federal Power Commission, Chicago, Illinois; T. L. Vander Velde, Chief, Section of Water Supply, Division of Engineering, Michigan Department of Health, Lansing, Michigan; Paul J. Waite, State Climatologist, U. S. Weather Bureau, Madison, Wisconsin; Fredrick H. Waring, Chief Engineer, State Department of Health, Columbus, Ohio; George Whetstone, U. S. Geological Survey, Columbus, Ohio; G. H. Wood, District Engineer, Department of Northern Affairs and National Resources, Water Resources Branch, Ottawa, Ontario; Frank L. Woodward, Director, Division of Environmental Sanitation, Minnesota Department of Health, Minneapolis, Minnesota.

The investigators are no less indebted to the various persons who were contacted at the individual agencies during the course of the study. The limitations of space do not permit listing them here, but the majority have been identified in the tabulation of sources in Table 1. To all these per-

2. PROCEDURE

In order to expedite the search for data sources, the study was divided into two basic parts: the hydrographic and the meteorological. This was a natural division since the bulk of the meteorological data was expected to originate at points apart from the sources of hydrographic data. However, it was known that certain agencies obtaining routine hydrographic data also obtained concomitant meteorological observations. In such cases, it became the responsibility of the personnel in the hydrographic division of the study to ascertain the necessary information relative to the meteorological observations, and to then transmit it to personnel in the meteorological division. The primary reason that many meteorological sources are different from hydrographic sources is because it was deemed necessary to obtain meteorological data not only around the periphery of the Lakes, but inland for some distance as well. The influence of the Lakes on weather conditions, and the influence of weather on the Lakes, is known to encompass an area around the Lakes as well as over the Lakes themselves. The exact limits of this "area of influence" are yet not completely determined, but for the purposes of this study have been confined to the drainage area of the Great Lakes (Fig. 7).

The first effort by project personnel to locate all pertinent sources of meteorological data within the Great Lakes basin was made by contacting the National Weather Records Center of the U. S. Weather Bureau at Asheville, North Carolina, and the Meteorological Division of the Canadian Department of Transport in Toronto, Ontario. These two agencies provided project personnel with information on meteorological data that is published. This comprised the largest source of all types of data uncovered by the project: 808 sources or 68.6 per cent of the total of 1177 sources (see Table 4, p. 133).

All other meteorological data sources ascertained by the project are comprised of unpublished, unprocessed data on file at each station or a central repository. The data are recorded by U. S. Coast Guard Stations (some of the data from a few of these are published in U. S. Weather Bureau climatological summaries), water treatment plants, industries and power plants, sewage treatment plants, paper mills, commercial and research lake vessels, and a few other sources such as university research groups, individual observers, and governmental and public service organizations.

The search for hydrographic sources was initiated by concentrating first upon the water treatment plants. Information concerning data available from such plants in the United States was obtained by contacting the head offices of the public health departments of the states bordering the Great Lakes: Illinois, Indiana, Michigan, Minnesota, Ohio, Pennsylvania, New York, and Wisconsin. In Michigan and Ohio, at least a portion of the data from these plants was found to be available from the head offices, where it is kept on file. In the other states, data are retained in the files of the individual plants, from which they may be obtained. Information on water treatment plants in Ontario was furnished by the Ontario Water Resources Commission.

Another source investigated early in the study comprised the power plants which utilize water from the Lakes. A list of all such plants on

the United States side of the Lakes was obtained from the Federal Power Commission at Chicago; this list included public utilities, industries, and municipal plants. For information on the Canadian side, the Hydro-Electric Power Commission of Ontario was contacted.

The pertinent water treatment plants and power plants were then contacted individually. In some cases personal visits were possible, but usually contact was by mail. Each potential data source not visited by project personnel was sent a letter outlining the project, its aims and purpose, and the type of cooperation sought. Included with the letter was a three-page questionnaire designed to facilitate the agency's reply. The questionnaire, which is reproduced in Figure 1, is a form on which each observation could be entered, whether hydrographic or meteorological. Space for pertinent information concerning the observation was also provided. It will be noted that a good deal of the information requested on the questionnaire, i.e., time of observation, type of instrument or process, instrument sensing element, and name of observer, are items which were not required under the terms of the study, but were considered pertinent and hence ascertained whenever possible. Information relating to these items was not determined for all cooperating agencies, and is not included in this report. That which is known is on file with the Great Lakes Research Institute.

It should be pointed out here that rigid adherence to a strict policy in contacting and obtaining information from the various agencies was not possible; that is, in some cases the use of questionnaires was impractical, in others they served to collect information that otherwise would likely have been overlooked.

The water treatment plants and power plants constituted the bulk of the hydrographic data sources from which any great variety of data were available. However, a number of additional agencies contacted also were able to make significant contributions. Specific reference to these agencies is made in section 3 of this report.

During the course of the investigation, items of pertinent literature appeared from time to time, and have been included in the Bibliography (see Appendix). Also included in the Bibliography are selected references from a bibliography of the Great Lakes (Van Oosten, John. Great Lakes Fauna, Flora, and their Environment. A Bibliography. Great Lakes Commission, Ann Arbor, Mich., 1957). Selection of these references was based upon applicability to the interest area of the project.

Contained within Van Oosten's bibliography are 138 papers from Lake Erie on subjects within the interest area of this project, 57 from Lake Michigan, 22 from Lake Superior, 19 from Lake Ontario, 13 from Lake Huron, and 42 pertinent to all the Great Lakes. Of these, there are certain papers which cover comparable subjects at different times and which have promise of providing direct material upon possible changes in the Great Lakes.

Figure 1

UNIVERSITY OF MICHIGAN
GREAT LAKES RESEARCH INSTITUTE
U. S. Dept. of Interior - Great Lakes Collateral Data

QUESTIONNAIRE ON METEOROLOGICAL AND HYDROGRAPHIC RECORDS

Organization_____ Address_____ Date_____

Parameter Measured	Time of Observation	Period of Record	Type of Instrument or Process	Instrument Sensing Element		Disposition of Data	Name of Observer	Remarks
				Exposure	Location			
Air temperature								
extremes								
Water temperature								
extremes								
ice formation								
ice dissipation								

Figure 1 (cont.)

Parameter Measured	Time of Observation	Period of Record	Type of Instrument or Process	Instrument Sensing Element		Disposition of Data	Name of Observer	Remarks
				Exposure	Location			
Precipitation								
liquid								
solid								
solid cover								
extremes								
Wind speed								
instantaneous								
total movement								
extremes								
Wind direction								
Humidity								
dew point								
Solar radiation								
Evaporation								

Figure 1 (cont.)

Parameter Measured	Time of Observation	Period of Record	Type of Instrument or Process	Instrument Sensing Element		Disposition of Data	Name of Observer	Remarks
				Exposure	Location			
Pressure								
Visibility								
Cloud cover								
types								
heights								
Other (specify)								
Chemical Analyses								
Total alkalinity								
Total hardness								
pH								
Other (specify)								

Figure 1 (cont.)

Parameter Measured	Time of Observation	Period of Record	Type of Instrument or Process	Instrument Sensing Element		Disposition of Data	Name of Observer	Remarks
				Exposure	Location			
Physical Analyses								
Turbidity								
Color								
Odor								
Other (specify)								
Biological Analyses								
Standard plate count								
Coliform								
Plankton								
Water level								
Water currents								
Wave heights								
Other (specify)								

The bibliography appended to the report does not represent, and is not intended to represent, an exhaustive compilation of all literature pertinent to hydrographic and meteorological aspects of the Great Lakes. It is included for the convenience of the reader, as a compilation of pertinent literature that has come to the attention of the investigators during the course of this study.

3. COMPILATION OF INFORMATION

Most of the information relating to sources of data is of such nature that it can be readily tabulated. In Table 1 are listed sources of hydrographic and/or meteorological data that are located on the periphery of the Lakes. All meteorological stations located no farther than two miles from the lake shore are included in this table. Entries have been listed geographically, proceeding counterclockwise around each Lake, as noted in the table.

In Table 2 are listed all those sources of meteorological data occurring within the Great Lakes drainage basin but located more than two miles from the nearest Great Lake. Geographical listing by state or province is shown. It is not feasible in Table 2 to list each station geographically, hence items have been entered alphabetically by state or province. Individual stations may be located by use of the included coordinates.

To facilitate geographical orientation, a series of six orientation plates have been included, five within Table 1 and one preceding Table 2. Figures 2 through 6 depict the five Lakes: Superior, Michigan, Huron, Erie, and Ontario. The St. Marys River appears in Figure 2, and the St. Clair River, Lake St. Clair, Detroit River, and Niagara River in Figure 6. Figure 7 shows the entire area of the Great Lakes drainage basin. All meteorological sources within this basin that have been ascertained by the present research are listed, partly in Table 1 and in all of Table 2; all hydrographic data sources on the periphery of the Lakes are listed as part of Table 1. In addition, station circles are shown in Figure 7 outside the drainage basin periphery. These are meteorological stations that are in close proximity to the basin periphery. They are listed as part of the present research since there are frequent occurrences where suitable data sources close to the periphery, but within the basin, are not available.

Table 3 contains all those sources which, for specified reasons, had no usable data, or so few that they were considered unsuited to the purposes of this study.

4. EXPLANATION OF TABLES

An explanation of the contents of Tables 1, 2, and 3 is given at this point in order to facilitate understanding of the information presented.

I. Table 1

A. Pagination

The large volume of information pertinent to each data source has necessitated the use of two pages for each source. These appear on facing pages which are numbered consecutively. The information is presented in eight groups (five Lakes, three connecting waterways) beginning with Lake Superior and proceeding eastward. Data sources are listed geographically within each group beginning at an arbitrary point and proceeding counterclockwise around each Lake or through each of the waterways.

Each data source location is numbered serially within its group, the number appearing in the first column of each facing page. Numbers identify the location on the second page where designation by name has been omitted.

B. Agency and Contact

In column 3, Agency refers to the particular organization which obtains data at the specific location designated in column 2; Contact refers to the person within the organization who should be consulted in regard to any data recorded.

In the tabulations a contact is not given for stations whose records are available from some central compilation office. Agencies included in this category are as follows:

1. U. S. Weather Bureau First Order, Second Order and Cooperative stations, U. S. Naval Air Stations, and U. S. Air Force Bases. Data from these agencies are filed with and obtainable from the National Weather Records Center, Asheville, North Carolina.

2. Canadian Meteorological Division Class I, II, III, and c stations. Data from these agencies are filed with and obtainable from the Climatological Section, Meteorological Division, Department of Transport, Toronto, Ontario.

3. U. S. Lake Survey water level records. Data are obtainable from the U. S. Lake Survey Office, 630 Federal Building, Detroit 26, Michigan.

4. Canada Hydrographic Service water level records. Data are obtainable from the Dominion Hydrographer, Canadian Hydrographic Service, Canada Department of Mines and Technical Surveys, Ottawa, Ontario.

5. U. S. Coast Guard installations. With respect to collection of

meteorological and lake state data, Coast Guard installations are divided into two categories: those making regular reports every six hours to the U. S. Weather Bureau, and those which take four-hourly observations; most of the latter are retained by the Coast Guard.

Data from the former category are obtainable from the National Weather Records Center at Asheville, and from the latter are obtainable from U. S. Coast Guard Headquarters, Washington, D. C. Coast Guard station personnel retain copies of the meteorological logs for a period of twelve months; hence, data for any immediately preceding year may be obtained directly from the station in question. In Table 1, the six-hourly and four-hourly stations are so designated.

6. Naval Air Stations; U. S. Air Force Bases. Data are filed with and obtainable from the National Weather Records Center at Asheville.

7. Michigan municipal water treatment plants. All plant records are filed with the Michigan Department of Health. Information on Upper Peninsula plants may be obtained from the Michigan Department of Health, 19th Street and 13th Avenue North, Escanaba, Michigan. Information on Lower Peninsula plants is obtainable from the Michigan Department of Health, Division of Engineering, Lansing 4, Michigan.

In Column 3 of Table 1, contacts for Michigan water treatment plants are indicated by either Escanaba or Lansing, to specify the data location.

C. Modification of Contact Procedure

In regard to municipal water treatment plants located in Ohio, a modified contact procedure is recommended. Chemical data obtained at the plants are filed with the Ohio State Department of Health at Columbus, but some physical data may be retained at plants and may be obtained directly from the individual plant operators. Initial inquiries should be addressed to the Chief Engineer, State Department of Health, 301 Ohio Departments Building, Columbus, Ohio.

In Column 3 of Table 1, contacts for Ohio water treatment plants will indicate the name of the superintendent of the plant, followed by Columbus.

D. Period of Record

The number of years over which records are available has been ascertained for a large number of the located data sources. Under the period of record for a particular agency, a specific date followed by a dash indicates that data are available from that year to the present. Records pertaining to U. S. Weather Bureau First and Second Order and Cooperative stations indicate the amount of data available in terms of total years. These are not necessarily consecutive years; hence, ascertainment of any missing record is accomplished only by examination of the complete history of the station in question. Accordingly, periods of record for U. S. Weather Bureau stations are entered in Table 1 as

total years of data, and specific dates are not given.

Periods of record of Canadian Meteorological Division stations are not, at the time of publication, readily available for all stations. The Climatological Section of the Division is, however, in the process of compiling this information which should be available within a few weeks after the date of issue of this report.

Information of the lengths of records of U. S. Coast Guard installations likewise is not readily available, but may be obtained for four-hourly stations from the Coast Guard Headquarters at Washington, D. C., and for six-hourly stations from the National Weather Records Center at Asheville.

Water level records obtained from gaugings of the U. S. Lake Survey and Canadian Hydrographic Service are available back to 1860 for each Lake and for connecting waterways. The single exception is the St. Clair River, for which records are available back to 1898.

The water level records are regularly published as monthly means, in both tabular and hydrograph form, for each Lake taken as a unit. Records for individual gauges are available only upon specific request. Periods of record vary among individual gauges, and hence the date 1860 does not necessarily refer to any particular gauge, but rather to average values for each Lake.

United States water level data are available from the U. S. Lake Survey, U. S. Army Corps of Engineers, 630 Federal Building, Detroit 26, Michigan.

Canadian water level data are available from the Dominion Hydrographer, Canadian Hydrographic Service, Canada Department of Mines and Technical Surveys, Ottawa, Ontario.

The periods of record for some sources may vary internally, that is, different observations have been carried out for varying lengths of time. In such cases the notation "variable--see data" has been entered in the Period of Record column, and the appropriate dates have been entered in the individual parameter columns. In some of these cases, the period of record is known for some data, but not for others. In this event, observations known to be taken, but for which the period of record is unknown, are indicated by "(X)".

The symbol "X" (not enclosed by parentheses) is used in two instances, 1) whenever it is known that the period of record is homogeneous for the observations taken; that is, whenever there is a single known period of record which embraces all the observations made at the particular station, and 2) whenever it is known that observations are made at the station, but the period of record is not known for any of them.

Unmarked spaces in Table 1 indicate that, so far as it is known to the investigators, no observations are made of that parameter.

E. Data

Many meteorological data are obtained by U. S. Weather Bureau First and Second Order stations, Canadian Meteorological Division Class I stations, U. S. Coast Guard installations, U. S. Naval Air Stations, and U. S. Air Force Bases. The distinctions between U. S. Coast Guard Stations, as far as their meteorological observations are concerned, are made on page 15. U. S. Naval Air Stations and Air Force Bases are equipped and staffed to record the data called for by WBAN (Weather Bureau-Air Force-Navy) Form 10; hence, for the purposes of this report, they are placed in the same classification as U. S. Weather Bureau First and Second Order stations.

The distinctions between U. S. Weather Bureau First and Second Order stations are as follows: First Order stations are staffed by full-time Civil Service personnel. The stations may or may not operate 24 hours per day, they may or may not be equipped with full instrumentation, hence they may or may not take special or synoptic observations. Those First Order stations that do not operate at all times or take full observations are functionally important in the work of the Bureau; there are only one or two included in this report. Second Order stations are staffed by certificated personnel to take full synoptic weather observations; they may or may not be Civil Service personnel. Examples of Second Order stations are U. S. Coast Guard Stations and Civil Aeronautics Administration communications stations at airports otherwise without Weather Bureau personnel.

A substation of the U. S. Weather Bureau is staffed by a volunteer individual or organization to make at least one observation per day. He is furnished with equipment to record precipitation and/or temperature extremes; he may or may not have equipment for measuring additional weather elements. This type of data source is referred to in this report as a USWB Cooperative.

The Canadian Meteorological Division Class II station also fits this description. Canadian Class III stations are equipped only with a rain gauge; Canadian c stations are equipped only with a sunshine recorder and/or an anemometer. These stations are referred to in this report, respectively, as CMD I, CMD II, CMD III, and CMD c.

To avoid lengthy repetition of citing the data in the tabulations that are recorded by USWB First and Second Order stations, CMD Class I stations, and U. S. Coast Guard, Naval Air, and Air Force stations, the parameters taken by each group are specified below. In Table I, a page and paragraph reference is given in the Other column under Meteorological Data, referring to the following parameters measured at each station:

1. U. S. Weather Bureau First and Second Order stations, U. S. Naval Air Stations, U. S. Air Force Bases, and Canadian Meteorological Division Class I stations:

ceiling height	wind direction
sky condition	wind speed
visibility	air temperature
present weather	cloud types*
obstructions to vision	precipitation
sea level pressure	barometric tendency
dew point	unusual phenomena

* Canadian Class I stations report cloud types in tenths of total sky covered; many record sunshine.

2. U. S. Coast Guard installations

   a. Six-hourly reporting stations (data transmitted to U. S. Weather Bureau every six hours):

sky cover	ice, kind
wind direction	ice thickness
wind speed	ice, effect on navigation
visibility	ice, change
present weather	air temperature
obstructions to vision	temperature, wet bulb
past weather	water temperature
waves, direction from	sea level pressure
wave period	unusual phenomena
wave height	

   b. Four-hourly reporting stations (data retained at Coast Guard Headquarters, Washington, D. C.):

wind direction	present weather
wind speed	cloud types
sea level pressure	cloud direction
air temperature	cloud speed
humidity	lake state
water temperature	

F. Second Page

The "second pages" of Table 1 are pertinent only to those installations which obtain hydrographic data. However, in order to maintain proper continuity, the serial numbers of all data sources, both meteorological and hydrographic, are entered on this page.

The second column indicates the position in the Lake of the raw water intake. The first number refers to the distance (in feet) that the intake is located from the shore. The second number, enclosed in parentheses, indicates the depth of the intake below the surface of the water in feet. This indicated depth must be taken as only an approximate figure in most cases, due to the difficulty in ascertaining the actual reference level used in computing the depth. It is usually the depth below mean lake level.

G. U. S. Public Health Service Special Study

Certain water treatment plants on Lake Michigan are of particular interest in connection with a special study presently being conducted by the U. S. Public Health Service through its Chicago (Region V) offices. This study was prompted by the difficulty of many Lake Michigan plants to obtain effective water filtration, due primarily to intense seasonal plankton blooms. A portion of this study involves the identification of water quality conditions which contribute to the difficulty of obtaining proper filtration runs. In this connection, efforts are being made to standardize observation techniques utilized in the determination of chemical, physical, and biological characteristics of the raw water taken in by the various plants.

The study is at present designed to extend through, and possibly beyond, 1958. During the period of the study, all participating plants will make the following observations, using a standard methodology prescribed by the U. S. Public Health Service: water temperature, air temperature, weather conditions, wind direction, wind speed, lake surface current direction, turbidity, pH, alkalinity, chlorine demand, and chlorine residual. Many of the cooperating plants obtained these observations prior to the initiation of the special study; a few expanded their operations to include them at least through the present year.

Water treatment plants are involved at the following locations: Green Bay, Wisconsin; Sheboygan, Wisconsin; Milwaukee, Wisconsin; Waukegan, Illinois; Evanston, Illinois; Chicago (South District Filtration Plant), Illinois; Gary-Hobart, Indiana; Michigan City, Indiana; Benton Harbor, Michigan; Holland, Michigan; Grand Rapids, Michigan; and Muskegon, Michigan. These plants are identified in Table 1 in the remarks column by the notation USPH cooperator.

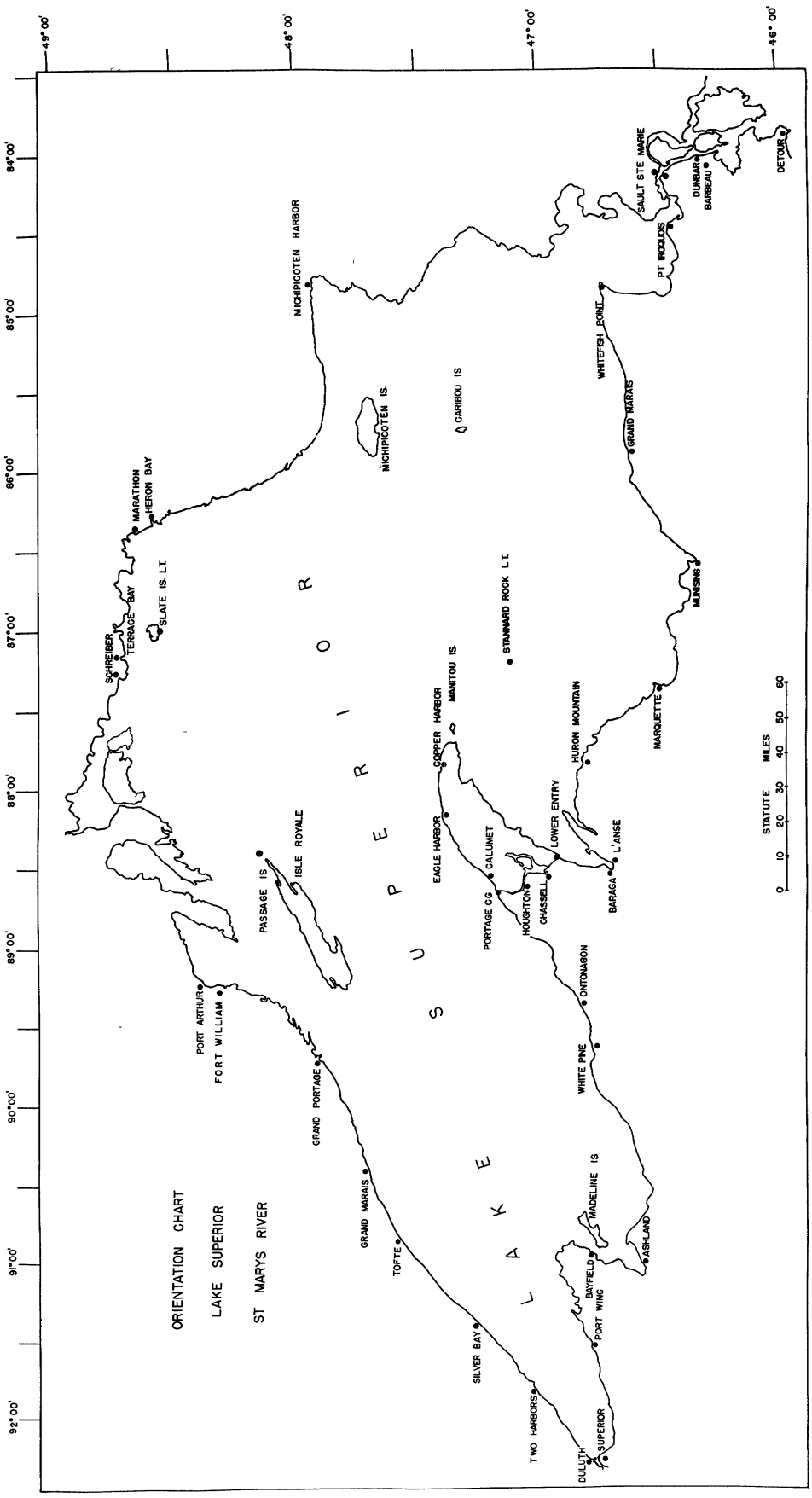

Figure 2. Orientation Chart, Lake Superior and St. Marys River

Table 1. Onshore Data Sources

LAKE SUPERIOR (beginning at international boundary and proceeding counterclockwise)

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
1	Grand Portage, Minn.	USWB cooperative	--			X	X	
2	Grand Marias, Minn.	USCG Rock of Ages Light (4 hrly)	--	X	X	X		p 15, 2b
3	Grand Marias, Minn.	USCG North Superior Lifeboat (6 hrly)	--	X	X	X		p 15, 2b
4	Grand Marias, Minn.	USWB cooperative	50			X	X	
5	Tofte, Minn.	USWB cooperative	16			X	X	
6	Silver Bay, Minn.	Reserve Mining Co. E. W. Davis	variable see data	1955-	1955-	1955-		pressure, 1955-
7	Silver Bay, Minn.	Water treatment plant A. A Jensen, Supt.	variable see data	1955-	1955-	1955-		
8	Two Harbors, Minn.	Water treatment plant R. W. Gustavson, City Clerk	--					
9	Two Harbors, Minn.	USCG Two Harbors Light (4 hrly)	--	X	X	X		p 15, 2b
10	Two Harbors, Minn.	USCG Split Rock Light (4 hrly)	--	X	X	X		p 15, 2b

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
1											
2											
3											
4											
5											
6	680 (50)	1955-		1955-	1955-	1956-	1955-			plankton (once/ year), 1956- lake level 1954	
7	525 (52)	1954-				1954-				lake level 1955	
8	--	(X)				(X)					
9											
10											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
11	Two Harbors, Minn.	USWB cooperative	65			X	X	
12	Two Harbors, Minn.	U. S. Lake Survey	--					
13	Duluth, Minn.	Water treatment plant A. V. Biele, Chemist	1948-					
14	Duluth, Minn.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
15	Duluth, Minn.	USCG Superior Entry Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
16	Duluth, Minn.	USWB First Order	80	X	X	X	X	p 15, 1
17	Duluth, Minn.	Minnesota Power & Light Co. Hubbell Carpenter, Vice Pres. & Ch. Engr.	--			X		weather
18	Duluth, Minn.	U. S. Lake Survey	--					
19	Superior, Wisc.	Superior Water, Light, and Power Co. W. R. Olsen, Ch. Engr.	1942-					
20	Superior, Wisc.	USWB cooperative	50			X	X	
21	Port Wing, Wisc.	USWB cooperative	12			X	X	
22	Bayfield, Wisc.	USCG Devils Island Light (4 hrly)	--	X	X	X		p 15, 2b

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
11											
12										lake level (cont.)	
13	1500 (65)	X		X	X	X	X			NH_3, Diss. O_2, Total Fe, BOD, Plankton (see remarks)	Plankton studies during 1939, 40, 41
14											
15											
16											
17											
18										lake level (cont.)	
19	slip at shoreline, 12 ft deep	X									
20											
21											
22											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
23	Bayfield, Wisc.	USCG Outer Island Light (4 hrly)	--	X	X	X		p 15, 2b
24	Bayfield, Wisc.	USCG Mooring (4 hrly)	--	X	X	X		p 15, 2b
25	Bayfield, Wisc.	USCG La Pointe Light (4 hrly)	--	X	X	X		p 15, 2b
26	Bayfield, Wisc.	USWB cooperative	38			X	X	
27	Madeline Is., Wisc.	USWB cooperative	14			X	X	
28	Ashland, Wisc.	USWB cooperative	variable see data			55	58	
29	Ashland, Wisc.	Water treatment plant J. A. Snow, Mgr.	"many years"	(X)				
30	Ashland, Wisc.	Lake Superior District Power Co., K. S. Austin, Ch. Engr.	1949-					
31	Ashland, Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
32	White Pine, Mich.	Water Treatment Plant (White Pine Copper Co.) (Escanaba)	variable see data	1956-		1955-		cloud cover, 1952
33	Ontonagan, Mich.	USWB cooperative	1916-				X	
34	Ontonagan, Mich.	USWB cooperative	38			X	X	

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
23											
24											
25											
26											
27											
28											
29	2000 (22)	(X)						(X)			
30	slip on W. side of plant	(X)									intake water artificially heated in winter
31											
32	-- (30)	1955-		1954-	1954-	1952-	1954-	1952-		color, 1952 fluoride, 1955	
33											
34											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
35	Portage, Mich.	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
36	Houghton-Keweenaw, Mich.	USCG Houghton-Keweenaw Light (4 hrly)	--	X	X	X		p 15, 2b
37	Calumet, Mich.	Calumet & Heckla water treatment plant (Escanaba)	variable see data	1955-	1955-			
38	Calumet, Mich.	Tamarack water treatment plant (Escanaba)	1955-	X	X			
39	Eagle Harbor, Mich.	USCG Light (6 hrly)	--	X	X	X		p 15, 2a
40	Copper Harbor, Mich.	USWB cooperative	16				X	
41	Manitou Island, Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
42	Keweenaw (Chassell), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
43	Lower Entry, Mich.	U. S. Lake Survey	--					
44	Baraga, Mich.	USWB cooperative	16				X	
45	Baraga, Mich.	Water treatment plant (Escanaba)	1955-	X	X			
46	L'Anse, Mich.	Water treatment plant (Escanaba)	variable see data	1950-				
47	L'Anse, Mich.	USWB cooperative	20			X	X	

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
35											
36											
37	900 (12)	1955-				1956-		1955-			weekly temps 1950-; weekly coli. 1950-
38	350 (16)	X				X		X			weekly turbidity and coliform 1950-
39											
40											
41											
42											
43										lake level (tri-daily)	
44											
45	--(16)	X						X			hourly temps, but unreliable thermometer
46	1000 (48)	1954-			1956-	1956-		1955-		color, 1956-	
47											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
48	Huron Mountain, Mich.	USWB cooperative	--				X	
49	Stannard Rock, Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
50	Marquette, Mich.	USWB First Order	87	X	X	X	X	p 15, 1
51	Marquette, Mich.	USCG Passage Island Light (6 hrly)	--	X	X	X		p 15, 2a
52	Marquette, Mich.	U.S. Lake Survey	--					
53	Marquette, Mich.	Northern Mich. Coll. of Ed., Geography Dept.	--			X	X	pressure, rel. hum., dew pt.
54	Marquette, Mich.	Water treatment plant (Escanaba)	variable see data			1953-		
55	Marquette, Mich.	Cliffs Dow Chemical R. W Jenner, Vice Pres. and Gen. Mgr.	1957-					
56	Marquette, Mich.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
57	Munising, Mich.	USWB cooperative	62			X	X	
58	Munising, Mich.	Water treatment plant (Escanaba)	1955-	X		X		
59	Munising, Mich.	Munising Paper Co. P. A. Haag, Plant Engr.						
60	Munising, Mich.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b

No.	Intake location (ft.)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
48											
49											
50											
51											
52										lake level (cont.)	
53											
54	1000 (68)	1953-			1955-	1953-		1951-			recording thermograph
55	700 (20)	X									
56											
57											
58	-- (50)	X						X			
59	450 (40)	X									
60											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
61	Au Sable (Grand Marais), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
62	Grand Marais, Mich.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
63	Whitefish Point, Mich.	USWB cooperative	variable see data			49	51	
64	Whitefish Point, Mich.	USCG Light (6 hrly)	--	X	X	X		p 15, 2a
65	Caribou Island, Ont.	Canada Dept. of Transport (lighthouse)	--	at least 16	at least 16			weather
66	Michipicoten Harbor, Ont.	Canadian Hydrographic Service	--					
67	Heron Bay, Ont.	CMD II	--			X	X	
68	Marathon, Ont.	CMD II	--			X	X	
69	Marathon, Ont.	Marathon Paper Co. Colin MacMillan	1947-			X	solid cover only	pressure, 1954
70	Slate Island, Ont.	Canada Dept. of Transport (lighthouse)	--	X	X			weather
71	Terrace Bay, Ont.	Kimberly-Clark Paper Co. J. Wade, Tech. Supt.	variable see data					
72	Schreiber, Ont.	CMD II	variable see data	(X)	(X)	(X)	40	(cloud cover)

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
61											
62											
63											
64											
65											
66											
67											
68											
69	1600 (30)	X hourly			X 1/mo.	X 1/mo.	X 1/mo.	X 1/wk.		Ca,Mg,Fe,Cl,SO_4, 1/mo.	chem data available from J.F.J. Thomas, Head, Ind. Waters Sec., Ind. Mins. Div., Dept. Mines & Tech. Surveys, Ottawa, Ont.
70											
71	1600 (34)	1948-		55-56						plankton, 1955	
72											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Dir.	Wind Speed	Air Temp.	Pcpn.	Other
73	Port Arthur, Ont.	Water treatment plant, Public Utilities Comm., E. A. Vigars, Mgr.	1938-	X		X		date of ice formation; weather
74	Port Arthur, Ont.	Canadian Hydrographic Service	--					
75	Fort William, Ont.	CMD I	--	X	X	X	X	p 15, 1
76	Isle Royale, Mich.	Mott Is. (USWB cooperative	18			X	X	
77	Isle Royale, Mich.	Washington Harbor (USWB cooperative)	20			X	X	
78	Passage Island, Mich.	USCG Light (6 hrly)	--	X	X	X		p 15, 2a

No.	Intake location (ft.)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
73	2400 (25)	X								complete chemical analysis of raw water made July-August, 1950	
74										water level, wave height	
75											
76											
77											
78											

ST. MARYS RIVER

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
1	Sault Ste. Marie, Mich.	Water treatment plant (Escanaba)	variable see data	1955-	1955-			(ice thickness)
2	Sault Ste. Marie, Mich.	USWB First Order	70	X	X	X	X	p 15, 1
3	Sault Ste. Marie, Mich.	USCG Lansing Shoal Light (6 hrly)	--	X	X	X		p 15, 2a
4	Sault Ste. Marie, Mich.	U. S. Lake Survey	--					
5	Sault Ste. Marie, Ont.	CMD II	--			X	X	
6	Sault Ste. Marie, Ont.	CMD II (Insectary)	--			X	X	
7	Sault Ste. Marie, Ont.	Canadian Hydrographic Service	--					
8	Point Iroquois (Brimley), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
9	Point Iroquois, Mich.	U. S. Lake Survey	--					
10	Little Rapids Cut (Sault Ste. Marie), Mich.	USCG Light Attendant (4 hrly)	--	X	X	X		p 15, 2b
11	Middle Neebish Cut (Barbeau), Mich.	USCG Light Attendant (4 hrly)	--	X	X	X		p 15, 2b

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
1	1300 (42)	(X)				1950-		1950-			coli. on daily basis only since 1957
2											period of record not entirely ascertained
3											
4										water level (cont.)	
5											
6											
7										water level (cont.)	
8											
9										water level (cont.)	
10											
11											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
12	Dunbar, Mich.	USWB cooperative	16			X	X	
13	Detour, Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
14	Detour, Mich.	USCG Light Attendant (4 hrly)	--	X	X	X		p 15, 2b
15	Detour, Mich.	USWB cooperative	28				X	
16	Detour, Mich.	U. S. Lake Survey	--					

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
12											
13											
14											
15											
16										water level (cont.)	

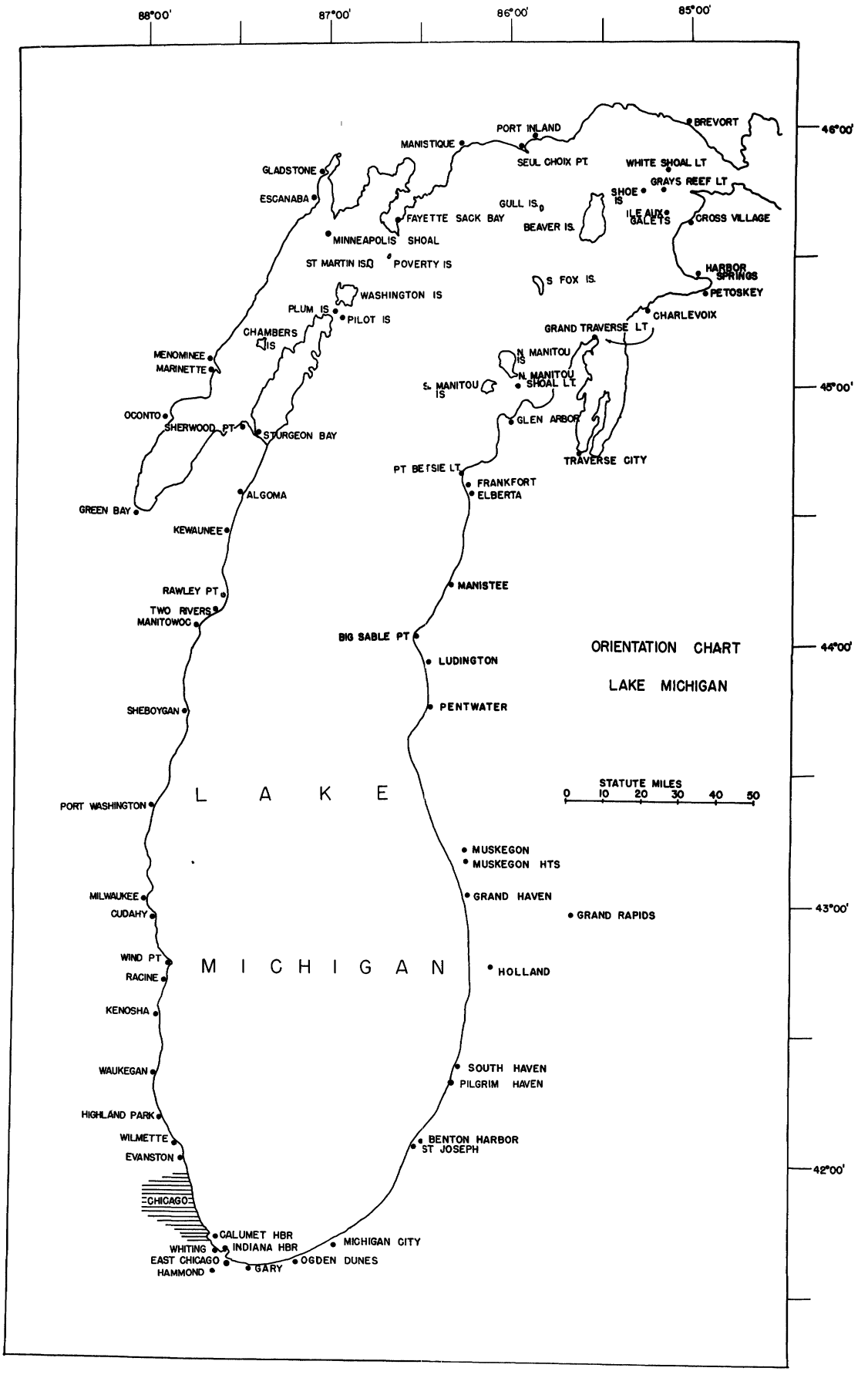

Figure 3. Orientation Chart, Lake Michigan

LAKE MICHIGAN (beginning on the north shore at the Straits of Mackinac and proceeding counterclockwise)

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
1	Brevort, Mich.	USWB cooperative	5				X	
2	Port Inland, Mich.	USWB cooperative	5				X	
3	Seul Choix Point (Gulliver), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
4	Manistique, Mich.	USWB cooperative	22			X	X	
5	Manistique, Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
6	Fayette Sack Bay, Mich.	USWB cooperative	38			X	X	
7	Gladstone, Mich.	Water treatment plant (Escanaba)	variable see data	(X)		1935-		
8	Escanaba, Mich.	USWB First Order	87	X	X	X	X	p 15, 1
9	Escanaba, Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
10	Escanaba, Mich.	Water treatment plant (Escanaba)	variable see data	1953-	1957-	1946-		
11	Minneapolis Shoal, Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
12	Menominee, Mich.	Water treatment plant	variable see data	ca 1880—		ca 1880-	ca 1880-	ice formation & dissipation ca 1880-
13	Menominee, Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
1											
2											
3											
4											
5											
6											
7	1500 (35)	1955-						1954-		color, 1954-	
8											
9											
10	-- (--)	1953-		1953-	1953-	1954-	1953-	1948-	1948-	odor, 1948-; color, 1948-	
11											
12	conflicting info.	1945-		1951-	1945-	1945-	(X)	1945-	1945-	color, 1945-	
13											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
14	Marinette, Wisc.	Water treatment plant	--					
15	Marinette, Wisc.	USWB cooperative	40			X	X	
16	Oconto, Wisc.	USWB cooperative	variable see data			69	48	
17	Green Bay, Wisc.	Water treatment plant A. Marx, Chemist	1957-	X	X	X		weather
18	Green Bay, Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
19	Green Bay, Wisc.	USCG Light Attendant (4 hrly)	--	X	X	X		p 15, 2b
20	Green Bay, Wisc.	U. S. Lake Survey	--					
21	Sherwood Point (Sturgeon Bay), Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
22	Chambers Island (Fish Creek), Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
23	Plum Island, Wisc. (c/o Washington Is.)	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
24	Pilot Island (Washington Is.), Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
25	St. Martin Island (Washington Is.), Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
14											
15											
16											
17	6000 (47)	X		X	X	X	X	X	X		intake in L. Michigan approx. 3 mi N of Kewaunee; USPH cooperator
18											
19											
20										lake level (cont.)	
21											
22											
23											
24											
25											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
26	Poverty Is. (Washington Is.), Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
27	Washington Is., Wisc.	USWB cooperative	14			X	X	
28	Sturgeon Bay, Wisc.	USWB cooperative	variable see data			61	54	
29	Sturgeon Bay, Wisc.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
30	Sturgeon Bay, Wisc.	U. S. Lake Survey	--					
31	Algoma, Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
32	Kewaunee, Wisc.	USWB cooperative	46			X	X	
33	Kewaunee, Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
34	Rawley Point (Two Rivers), Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
35	Two Rivers, Wisc.	Water treatment plant (USWB cooperative)	variable see data			8	8	
36	Two Rivers, Wisc.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
37	Manitowoc, Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
38	Manitowoc, Wisc.	USWB cooperative	variable see data			75	96	

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
26											
27											
28											
29											
30										lake level (cont.)	
31											
32											
33											
34											
35	6123 (33)	1933-		1933-	1933-	1933-					
36											
37											
38											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
39	Sheboygan, Wisc.	Water treatment plant C. Blabaum, Plant Supt.	1931-	X	X	X		weather, lake current dir. during 1958
40	Sheboygan, Wisc.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
41	Sheboygan, Wisc.	USWB cooperative	variable see data			62	60	
42	Port Washington, Wisc.	Water treatment plant	1949-	X		X		
43	Port Washington, Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
44	Port Washington, Wisc.	USWB cooperative	19				X	
45	Milwaukee, Wisc.	Water treatment plant T. E. Dolan, Chemist	variable see data	1958	1958	1958		weather, lake current dir. 1958
46	Milwaukee, Wisc.	USWB cooperative	7			X	X	
47	Milwaukee, Wisc.	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
48	Milwaukee, Wisc.	USWB First Order City	84	X	X	X	X	p 15, 1
49	Milwaukee, Wisc.	U. S. Lake Survey	--					
50	Cudahy, Wisc.	Water treatment plant J. J. Tiry, Director Pub. Works	1954-	X	X	X		

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
39	5000 (-) 1800 (-)	X		X	X	X					5000 ft intake used most USPH cooperator
40											
41											
42	3450 (32)	X		X	X	X		X	X		
43											
44											
45	6500 (67)	X		X	X	X		X	X	plankton	USPH cooperator
46											
47											
48											
49										lake level (cont.)	
50	2400 (24)	X		X	X	X		X	X		

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
51	Wind Point, Wisc.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
52	Racine, Wisc.	Water treatment plant G. H. Ruston, Mgr.	1930-	X		X	X	
53	Racine, Wisc.	USWB cooperative	variable see data			65	62	
54	Kenosha, Wisc.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
55	Kenosha, Wisc.	USWB cooperative	16			X	X	
56	Waukegan, Ill.	North Shore Sanitary Dist., R. E. Anderson, Chem-Engr.						
		(a) Waukegan Disposal Plant	variable see data	1947-			liquid 1938-; solid 1947-1952	cloud cover 1947-48
57-76	Waukegan, Ill.	(b) 20 obs. pts. between Wisc. & Cook Co., Ill., borders	1948-	X	X			weather, lake condition
77	Waukegan, Ill.	Water treatment plant H. C. Domke, Supt.	1928-	X	X			atmos. cond. lake level
78	Waukegan, Ill.	USWB cooperative	35			X	X	
79	Waukegan, Ill.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
80	Highland Park, Ill.	Water treatment plant	1929-			X		atmos. cond.

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
51											
52	3960 (40)	X		X	X	X		X	X		
53											
54											
55											
56											
57-76		X			X	X		X			locations of obs. pts. obtainable from R. E. Anderson
77	-- (--)	X		X	X	X		X	X		USPH cooperator
78											
79											
80	3400 (25) 2000 (25)	X		X	X	X		X	X		

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
81	Wilmette, Ill.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
82	Evanston, Ill.	Water treatment plant H. R. Frye, Supt.	1913-	X	X	X	X	
83	Evanston, Ill.	USWB cooperative	17				X	
84	Chicago, Ill.	USWB First Order City	88	X	X	X	X	p 15, 1
85	Chicago, Ill.	Chicago Univ. USWB cooperative	87	X	X	X	X	
86	Chicago, Ill.	Loyola Univ. USWB cooperative	25			X	X	
87	Chicago, Ill.	Chicago Lakeview Pump. Sta. (USWB cooperative)	25				X	
88	Chicago, Ill.	Chicago Sanitary Dist. Off. (USWB cooperative)	32				X	
89	Chicago, Ill.	South Dist. Filtration Plt. (USWB cooperative) J. R. Baylis, Engr. of Water Purification	1945-	X	X	X	X	
90	Chicago, Ill.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
91	Chicago, Ill.	U. S. Lake Survey	--					
92	Jackson Park (Chicago), Ill.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
81											
82	5690 (16)	X		X	X	X		X	X	plankton	USPH cooperator
83											
84											
85											
86											
87											
88											
89	-- (--)	X		X	X	X		X	X	plankton, lake level	USPH cooperator
90											
91											
92											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
93	South Chicago, Ill.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
94	Hammond, Ind.	Water treatment plant M. Papach, Act. Supt.	1936-	X	X	X		visibility
95	Whiting, Ind.	USWB cooperative	48			X	X	
96	Whiting, Ind.	Water treatment plant M. H. Abraham, Supt.	1955-	X				
97	Indiana Harbor, Ind.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
98	Gary, Ind.	USWB cooperative	22			X	X	
99	Gary, Ind. (Gary-Hobart)	Water treatment plant H. L. Plowman, Jr., Ch. Chem.	1954-	X		X		
100	Gary, Ind.	U. S. Steel; T. W. Hunter, Gen. Supt.; D. T. Seaman, Div. Supt. of Power & Fuel	variable see data					
101	Gary, Ind.	Northern Ind. Public Serv. Co., D. H. Mitchell Plant, E. B. Heise, Mgr. Electric Production	Dec. 1956-	X	X	X		
102	Ogden Dunes, Ind.	USWB cooperative	7			X	X	
103	Michigan City, Ind.	Water treatment plant D. Ungareit, Pl. Supt.	1935-	X				atmos. cond.

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
93											
94	1) 5000 (24) 2) 1934 (17) 3) 1400 (15)	X		X	X	X		X		odor; lake surface	intakes: 1) used all yr; 2) & 3) used May-Sept.
95											
96	1696 (16)	X				X					
97											
98											
99	ca 6000 (35-38)	X		X	X	X	X	X	X	plankton, color, odor	USPH cooperator
100	1) 2900 (6-16) 2) 100 (-)	1950-					1953-			Ca, Mg, non-CO_3 salts, 1953-	
101	shoreline (6)	X								unspecified chem. anal.; water level	
102											
103	3000 (35)	X		X	X	X		X	X		2 intakes at same location; 24" & 42" diam. USPH cooperator

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
104	Michigan City, Ind.	Northern Ind. Public Serv. Co., Michigan City Plant; E. B. Heise, Mgr. Electric Production	1931-	X	X	X		
105	Michigan City, Ind.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
106	St. Joseph, Mich.	Water treatment plant (Lansing)	1952-					
107	St. Joseph, Mich.	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
108	Benton Harbor, Mich.	Water treatment plant (Lansing)	1951-	X	X	X		
109	Benton Harbor, Mich.	USWB cooperative	75			X	X	
110	Pilgrim Haven, Mich.	C. W. Shinn	3	X	X	X	X	pressure
111	South Haven, Mich.	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
112	South Haven, Mich.	Water treatment plant (Lansing)	1926-	X				
113	South Haven, Mich.	USWB cooperative	63			X	X	
114	South Haven, Mich.	Municipal power plant Roy Ewers, Mgr.	1915-					pressure
115	Holland, Mich.	Water treatment plant (Lansing)	1957-	X		X		

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
104	shoreline (14)	X								unspecified chem. anal., water level	
105											
106	1500 (25)	X		X		X		X		odor	
107											
108	3500 (28)	X		X	X	X	X	X	X	odor	USPH cooperator
109											
110											
111											
112	5600 (35)	X		X	X	X		X	X	color, odor	
113											
114											
115	4360 (46-50)	X		X	X	X		X	X	plankton, odor, CO_3, diss. CO_2, HCO_3	USPH cooperator

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
116	Holland, Mich.	USCG Moorings (4 hrly)	--	X	X	X		p 15, 2b
117	Grand Rapids, Mich.	Water treatment plant (Lansing)	1912-					
118	Grand Haven, Mich.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
119	Grand Haven, Mich.	USWB cooperative	16				X	
120	Grand Haven, Mich.	USWB cooperative	88			X	X	
121	Muskegon Heights, Mich.	Water treatment plant (Lansing)	1941-	X				
122	Muskegon, Mich.	Water treatment plant (Lansing)	1937-			X		
123	Muskegon, Mich.	USWB First Order	62	X	X	X	X	p 15, 1
124	Muskegon, Mich.	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
125	Pentwater, Mich.	USCG Moorings (4 hrly)	--	X	X	X		p 15, 2b
126	Ludington, Mich.	Water treatment plant (Lansing)	1954-	X				weather
127	Ludington, Mich.	USWB cooperative	--			X	X	
128	Ludington, Mich.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
129	Ludington, Mich.	USWB cooperative	62			X	X	

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
116											
117	6100 (57)	X		X	X	X	X	X	X	plankton, Mg, Cl, color	USPH cooperator
118											
119											
120											
121	4600 (42)		X	X	X	X	X	X	X	color, odor	
122	7000 (50)	X		X	X	X		X	X	Fl, Cl, color, odor	USPH cooperator
123											
124											
125											
126	2600 (45)	X				X		X			
127											
128											
129											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
130	Ludington, Mich.	U. S. Lake Survey	--					
131	Big Sable Point (Ludington), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
132	Manistee, Mich.	USWB cooperative	63			X	X	
133	Manistee, Mich.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
134	Elberta, Mich.	USWB cooperative	56			X	X	
135	Frankfort, Mich.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
136	Point Betsie, Mich.	USCG Light (6 hrly)	--	X	X	X		p 15, 2a
137	Glen Arbor, Mich.	USWB cooperative	4			X	X	
138	South Manitou Is., Mich.	USCG Light (6 hrly)	--	X	X	X		p 15, 2a
139	North Manitou Is., Mich.	USWB cooperative	4			X	X	
140	North Manitou Is., Mich.	USWB cooperative	--			X	X	
141	North Manitou Shoals (Leland), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
142	Grand Traverse (Northport), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
130										lake level (cont.)	
131											
132											
133											
134											
135											
136											
137											
138											
139											
140											
141											
142											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
143	Traverse City, Mich.	Water treatment plant (Lansing)	1954-					
144	Traverse City, Mich.	USWB Second Order CAA AP	64	X	X	X	X	p 15, 1
145	Traverse City, Mich.	Naval Air Station	1942-1945	X	X	X	X	p 15, 1
146	Charlevoix, Mich.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
147	Charlevoix, Mich.	USWB cooperative	71				X	
148	Petoskey, Mich.	Penn-Dixie Portland Cement Co., G. Davis, Supt.	--					
149	Petoskey, Mich.	USWB cooperative	6			X	X	
150	Little Traverse (Harbor Springs), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
151	Cross Village, Mich.	USWB cooperative	5				X	
152	White Shoal (Cross Village), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
153	Lansing Shoal, Mich.	USCG Light (6 hrly)	--	X	X	X		p 15, 2a
154	Grays Reef (Charlevoix), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
155	Ile Aux Galets (Charlevoix), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
143	1700 (34)	X				X		X			
144											
145											
146											
147											
148	50 (6)	X									
149											
150											
151											
152											
153											
154											
155											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
156	Beaver Is., Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
157	Beaver Is., Mich.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
158	Beaver Is., Mich.	USWB cooperative	--			X	X	
159	Gull Is., Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
160	South Fox Is., Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
161	Shoe Island, Mich.	USWB cooperative	--			X	X	

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
156											
157											
158											
159											
160											
161											

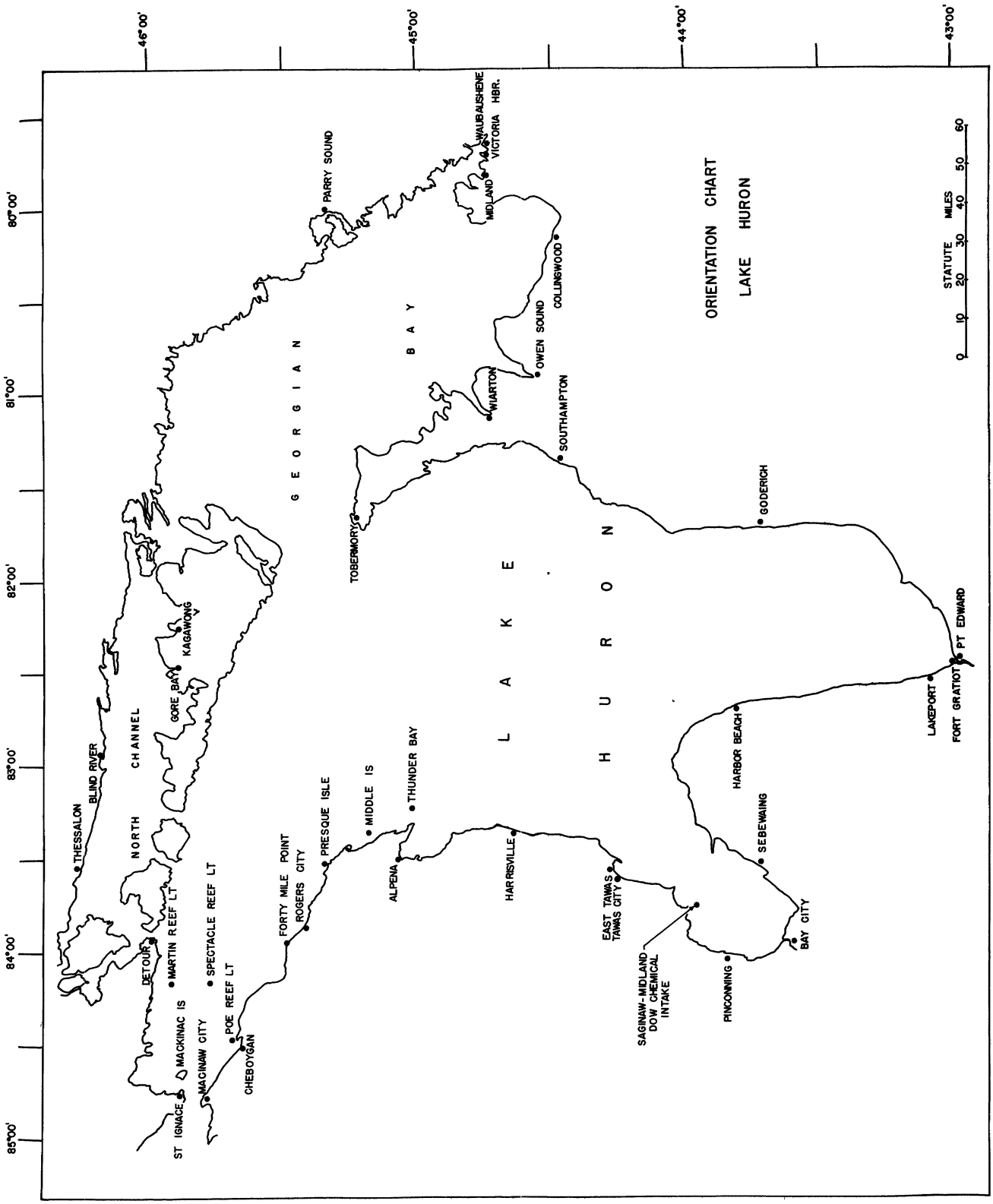

Figure 4. Orientation Chart, Lake Huron

LAKE HURON (starting at international boundary at False Detour Passage and proceeding counterclockwise)

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
1	Martin Reef, Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
2	St. Ignace, Mich.	Water treatment plant (Escanaba)	variable see data	1951-		1956-		weather (recent data)
3	Mackinac Is., Mich.	Water treatment plant (Escanaba)	variable see data					
4	Mackinac Is., Mich.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
5	Mackinaw City, Mich.	USWB cooperative	68	X	X	X	X	
6	Mackinaw City, Mich.	U. S. Lake Survey	--					
7	Cheboygan, Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
8	Cheboygan, Mich.	USWB cooperative	69				X	
9	Poe Reef (Cheboygan), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
10	Spectacle Reef (Cheboygan), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
11	Forty Mile Point (Rogers City), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
12	Rogers City, Mich.	USWB cooperative	7			X	X	

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
1											
2	before 1955: 225 (13) since 1955: 480 (20)	1951-			1952-	1952-		1950-			temps prior to 1951 obs. with unreliable thermometer
3	-- (--)					1957-		1946-			
4											
5											
6										lake level (cont.)	
7											
8											
9											
10											
11											
12											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
13	Rogers City, Mich.	Mich. Limestone and Chem. Div., U.S. Steel D. T. Van Zandt, Mgr.	"Several years"					
14	Presque Isle, Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
15	Middle Is. (Alpena), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
16	Thunder Bay Is. (Alpena), Mich.	USCG Light (6 hrly)	--	X	X	X		p 15, 2a
17	Alpena, Mich.	USWB First Order	86	X	X	X	X	p 15, 1
18	Alpena, Mich.	Water treatment plant (Lansing)	1945-	X				
19	Alpena, Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
20	Harrisville, Mich.	USWB cooperative	79			X	X	
21	East Tawas, Mich.	USWB cooperative	64			X	X	
22	Tawas City, Mich.	USCG Tawas Point Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
23	Saginaw-Midland intake, Mich.	Water treatment plant (Lansing)	1948-					
24	Midland, Mich.	Dow Chemical Co. M. Whiting, Mgr., Service Depts.	1949-	X	X	X	X	rel. humid.

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
13	shoreline (6)	X								"chemical anal." of raw water made once per year	
14											
15											
16											
17											
18	2000 (10)		X	X	X	X	X	X		color	
19											
20											
21											
22											
23	Whitestone Pt., north shore Saginaw Bay; (40)	X		X	X	X	X	X	X	free CO_2, Mg, Cl, color	
24	(see remarks)	X		X	X	X	X			Cl, SO_4, Si, Na	same intake as Saginaw-Midland

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
25	Pinconning, Mich.	Water treatment plant (Lansing)	1948-	X				
26	Bay City, Mich.	Water treatment plant (Lansing)	1925-	X				
27	Bay City, Mich.	USWB cooperative	63			X	X	
28	Bay City, Mich.	USCG Saginaw River Range Light (6 hrly)	--	X	X	X		p 15, 2a
29	Bay City, Mich.	U. S. Lake Survey	--					
30	Sebewaing, Mich.	USWB cooperative	2				X	
31	Harbor Beach, Mich.	Water treatment plant (Lansing)	1937-					
32	Harbor Beach, Mich.	U. S. Lake Survey	--					
33	Harbor Beach, Mich.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
34	Lakeport, Mich.	U. S. Lake Survey	--					
35	Fort Gratiot, Mich.	U. S. Lake Survey	--					
36	Point Edward, Ontario	Canadian Hydrographic Service	--					
37	Goderich, Ontario	CMD II	variable see data			(X)	57	

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
25	5400 (6)		X	X	X			X		Cl, odor	
26	18480 (19)		X	X	X	X	X	X	X	Mg, Cl, free CO_2, color, odor	
27											
28											
29										lake level (cont.)	
30											
31	2600 (14)		X	X	X	X		X	X	color, odor	
32										lake level (cont.)	
33											
34										lake level (cont.)	
35										lake level (cont.)	
36										lake level (cont.)	
37											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
38	Goderich, Ontario	Canadian Hydrographic Service	--					
39	Southampton, Ontario	CMD II	variable see data	at least 36	at least 36	(X)	74	
40	Tobermory, Ontario	CMD II	variable see data			(X)	35	
41	Wiarton, Ontario	CMD I	--	X	X	X	X	p 15, 1
42	Owen Sound, Ontario	CMD II	variable see data			(X)	66	
43	Collingwood, Ontario	CMD II	--			X	X	
44	Collingwood, Ontario	Canadian Hydrographic Service	--					
45	Midland, Ontario	CMD III	--				X	
46	Victoria Harbor, Ont.	CMD III	--				X	
47	Waubaushene, Ontario	CMD II	--			X	X	
48	Parry Sound, Ontario	CMD II	variable see data	at least 36	at least 36	(X)	75	
49	Kagawong, Ontario	CMD II	--			X	X	
50	Gore Bay, Ontario	CMD I	--	X	X	X	X	p 15, 1

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
38										lake level (cont.)	
39											
40											
41											
42											
43											
44										lake level (cont.)	
45											
46											
47											
48											
49											
50											

No.	Location	Agency and Contact	Period of Record	Meteorological Data			
				Wind Dir. Speed	Air Temp.	Pcpn.	Other
51	Gore Bay, Ontario	CMD II	variable see data		(X)	34	
52	Blind River, Ontario	CMD II	variable see data		(X)	21	
53	Thessalon, Ontario	Canadian Hydrographic Service	--				

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
51											
52											
53										lake level (cont.)	

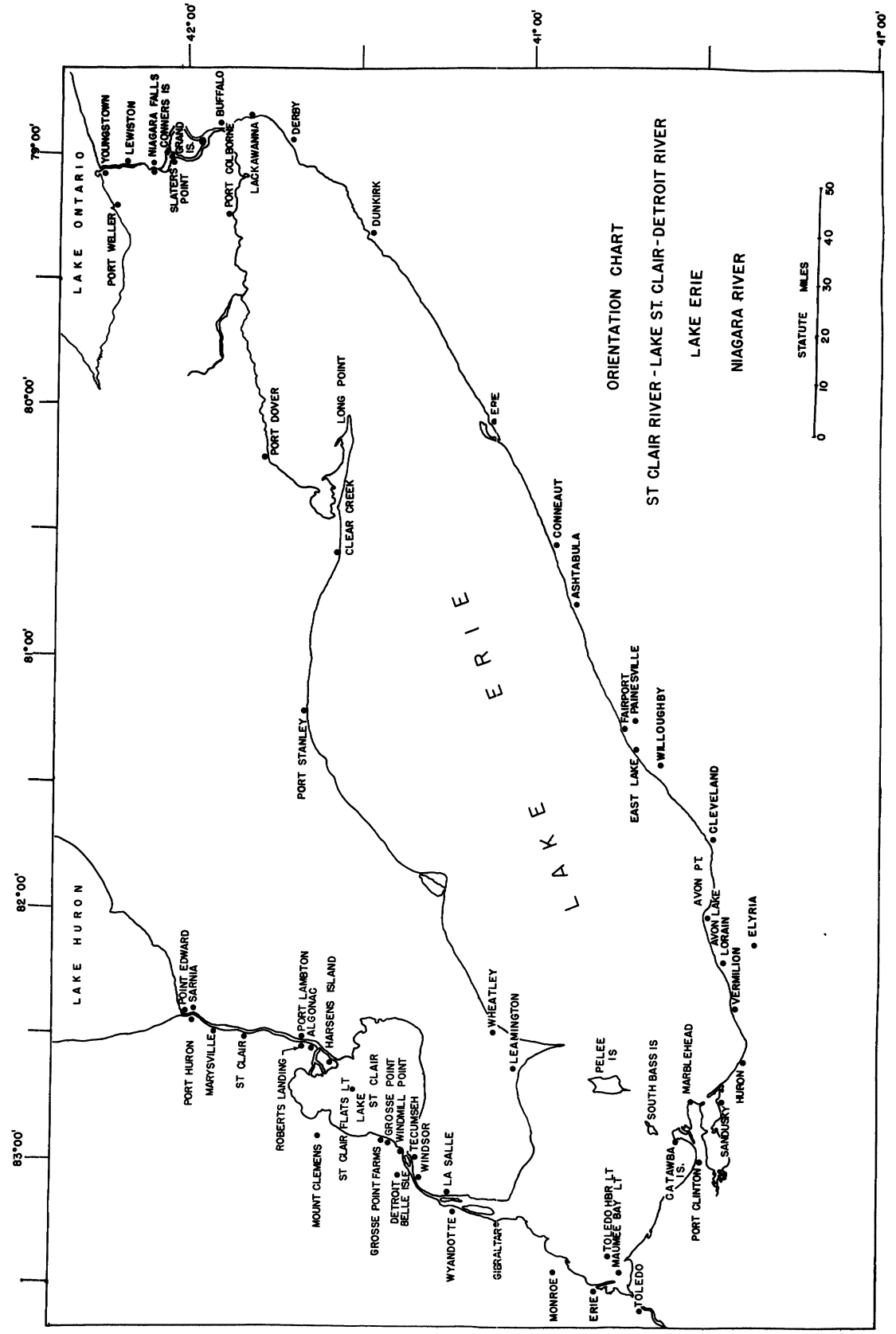

Figure 5. Orientation Chart, Lake Erie (including St. Clair River, Lake St. Clair, Detroit River, and Niagara River)

ST. CLAIR RIVER-LAKE ST. CLAIR-DETROIT RIVER (starting at the southern extreme of Lake Huron)

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
1	Port Huron, Mich.	Water treatment plant (Lansing)	1954-					
2	Port Huron, Mich.	U. S. Lake Survey	--					
3	Port Huron, Mich.	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
4	Sarnia, Ontario	Polymer Corp., Ltd. I. C. Rush, Mgr., Tech. Div.	variable see data	1949-	1949-	1949-	1949-	cloud cover, 1949- pressure, 1957-
5	Marysville, Mich.	Detroit Edison Plant W. W. Williams, Mgr. of Operations, Detroit	1953- possibly earlier					
6	St. Clair, Mich.	Detroit Edison Plant W. W. Williams, Mgr. of Operations, Detroit	1953- possibly earlier					
7	Roberts Landing, Mich.	U. S. Lake Survey	--					
8	Port Lambton, Ontario	Canadian Hydrographic Service	--					
9	Algonac, Mich.	U. S. Lake Survey	--					
10	Harsens Is., Mich.	U. S. Lake Survey	--					
11	Mt. Clemens, Mich.	Water treatment plant (Lansing)	1929-	X				

No.	Intake location (ft)	Hydrographic Data								Other	Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria			
		Raw	Treated					Coli.	Total		
1	-- (--)					X		X			
2										water level (cont.)	
3											
4	--	1956-									water temp. records discarded after two yrs.
5	--	X								water level	
6	--	X								water level	
7										water level (bi-daily)	
8										water level (cont.)	
9										water level (cont.)	
10										water level (tri-daily)	
11	5000 (16)		X	X	X	X	X	X		color, odor	

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
12	Mt. Clemens, Mich.	Selfridge Air Force Base	59	X	X	X	X	p 15, 1
13	St. Clair Flats (Sans Souci), Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
14	Grosse Point Farms, Mich.	Water treatment plant (Lansing)	1931-					
15	Grosse Point, Mich.	U. S. Lake Survey	--					
16	Windmill Point, Mich.	U. S. Lake Survey	--					
17	Tecumseh, Ontario	Canadian Hydrographic Service	--					
18	Windsor, Ontario	Water treatment plant G. H. Strickland, Supt.	variable see data			1930-		
19	Windsor, Ontario	Hydro-Electric Power Comm. of Ontario, J. C. Keith, Plant R. Shepley, Sta. Supt.	variable see data					
20	Detroit, Mich.	Water treatment plant (Water Works Park) (Lansing)	1924-	X				
21-24	Detroit, Mich.	Detroit Edison Plants: Conners Creek, Delray, River Rouge, Trenton Channel W. W. Williams, Mgr. of Oper., Detroit	1953- possibly earlier					

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
12											
13											
14	2000 (14-16)		X	X	X	X		X	X	odor	alk, pH reported rarely
15										water level (cont.)	
16										water level (cont.)	
17										water level (cont.)	
18	1926-1954: 350 (40) 1954-: 300 (40)	1930-		1950-	1950-	1928-	1950-	1930-	1930-	taste, odor, 1928- plankton, 1930- water level, 1956-	
19	see remks.	1952-		1955-	1955-		1955-			Cl, conductivity, 1955-	intake is channel dredged ca 15 ft deep 140 ft from shore
20	-- (26)		X	X	X	X		X	X	odor, plankton	
21-24	--	X								water level	

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
25	Detroit, Mich.	U. S. Lake Survey	--					
26	La Salle, Ontario	Canadian Hydrographic Service	--					
27	Wyandotte, Mich.	Water treatment plant (Lansing)	1946-	X	X			pressure, cloud cover
28	Wyandotte, Mich.	Wyandotte Chemical Corp. J. F. Hunter, Pollution Control Engineer	variable see data					
29	Wyandotte, Mich.	U. S. Lake Survey	--					
30	Belle Isle, Mich.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
31	Grosse Ile, Mich.	Naval Air Station	1942-	X	X	X	X	p 15, 1
32	Gibraltar, Mich.	U. S. Lake Survey	--					
33	Gibraltar, Mich.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
25										water level (cont.)	
26										water level (cont.)	
27	1800 (25)	X		X	X	X	X	X	X	Cl, Fl, odor	total bact. discont. after 1956
28	--	1950-		1937-			1937-			Cl, Ca, 1937-	
29										water level (cont.)	
30											
31											
32										water level (cont.)	
33											

LAKE ERIE (starting on United States side at mouth of Detroit River and proceeding counterclockwise)

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
1	Monroe, Mich.	Water treatment plant (Lansing)	1937-	X				
2	Monroe, Mich.	Univ. of Mich. Research	1956-	X	X	X	X	lapse rate
3	Monroe, Mich.	USWB cooperative	41			X	X	
4	Monroe, Mich.	U. S. Lake Survey	--					
5	Erie, Mich.	Consumers Power Co., M. C. Stiff, Electric Prod. Supt., Jackson, Mich.	1955-56-					
6	Toledo, Ohio	Water treatment plant R. R. Henderson, Supt. (Columbus)	1941-					
7	Toledo, Ohio	Interlake Iron Corp. J. L. Johnson, Gen. Supt.	variable see data		(X)	1953-		humidity, 1953- pressure, 1953-
8	Toledo, Ohio	Toledo Edison Co., Bay Shore Plant J. S. Grant, Chief Chemist	1952-53 1956-					
9	Toledo, Ohio	USWB cooperative	9			X	X	

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
1	5360 (23)		X	X	X	X	X	X	X	Ca, Mg, odor	
2											
3											
4										lake level (cont.)	
5	see remarks	X (summer only)		X	X	X	X			conductivity, surf. tension, susp. solids, diss. solids, total solids, Ca, Cl, Mg, Fe, Cu, Mn, Na, K, N, NH_3, NO_3, SiO_2, SO_4, Al_2O_3, CO_2, O_2 consumed, loss of solids by ignition, phenols, sulfides, odor	intake in 15-19 ft deep dredged channel originating at end of, and enclosed by, a N-S peninsula
6	10560 (10)			X	X	X	X	X	X	Mg	
7	shore line (0.4 to 13.4 ft.)	1 yr.		(X)	(X)		(X)			lake level, 1 yr.	intake figs re to water level of 570.15 ft.
8	--	X								unspecified "chemical data"	no winter temp data
9											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
10	Toledo, Ohio	USWB cooperative	7			X	X	
11	Toledo, Ohio	U. S. Lake Survey	--					
12	Toledo Harbor, Ohio	USCG Light (6 hrly)	--	X	X	X		p 15, 2a
13	Maumee Bay (Toledo), Ohio	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
14	Port Clinton, Ohio	Water treatment plant W. F. Crohen, Supt. (Columbus)	1912-					
15	Catawba Is., Ohio	USWB cooperative	variable see data			42	41	
16	South Bass Is. (Put-in-Bay), Ohio	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
17	Gibraltar Is. (South Bass Is.), Ohio	USWB cooperative	variable see data			42	41	
18	Marblehead, Ohio	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
19	Sandusky, Ohio	Water treatment plant O. F. Schoepfle, Supt. (Columbus)	1910-					
20	Sandusky, Ohio	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
21	Sandusky, Ohio	USWB First Order	81	X	X	X	X	p 15, 1

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
10											
11										lake level (cont.)	
12											
13											
14	1000 (0-8)			X	X	X	X	X	X		variable intake depth due to observed fluctuations in lake level (per plant supt.)
15											
16											
17											
18											
19	2500 (19.5)			X	X	X		X	X		
20											
21											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
22	Huron, Ohio	Water treatment plant S. R. Hetrick, Supt. (Columbus)	1909-					weather
23	Huron, Ohio	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
24	Vermilion, Ohio	Water treatment plant W. K. Eisenhauer, Supt. (Columbus)	1916-					
25	Lorain, Ohio	Water treatment plant G. Walkenshaw, Supt. (Columbus)	1910-	X		X		weather, lake surface
26	Lorain, Ohio	Ohio Edison Co., Edgewater Plant J. W. Mikels, Gen. Supt. of Power Production	variable see data	1956- (see remarks)	1956-			
27	Lorain, Ohio	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
28	Elyria, Ohio	Water treatment plant N. J. Humason, Supt. (Columbus)	1903-					
29	Avon Lake, Ohio	ater treatment plant R. R. Underhill, Supt. (Columbus)	1928-					
30	von Point, Ohio	Cleveland Elec. and Illum. Co., Avon Plant, C. A. Dauber, Dir. Civil & Mech. Engr., Cleveland	variable see data	1956-	1956-	1956-		humidity, 1956-

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
22	1000 (13	X		X	X	X	X	X			
23											
24	1904-50: 1300 (8) 1950-: 1300 (12)	X		X	X	X	X	X	X		
25	2000 (--)	X		X	X	X	X	X	X		
26	see remarks	1948-								water level 1948-	intake is 800 ft channel 30 ft wide, 8-10 ft deep meteorological data on file at Battelle Memorial Inst., Columbus, O.; letter of release needed from Ohio Ed.
27											
28	1500 (ca 13)	X		X	X	X	X	X	X		
29	1200 (15)			X		X		X			
30	see remarks	X									intake is 1000 ft channel dredged to 18 ft depth

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
31	Cleveland, Ohio	Water treatment plant F. J. Schwemler, Commissioner of Water; Columbus	1917-					
32	Cleveland, Ohio	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
33	Cleveland, Ohio	USWB cooperative (Cleveland Easterly Sewage Pl.)	3				X	
34	Cleveland, Ohio	USWB cooperative (Euclid Ave.)	14			X	X	pressure
35	Cleveland, Ohio	Cleveland Electric & Illuminating Co., Lake Shore Plant (5 mi. E downtown Cleveland) C. A. Dauber, Dir. Civil & Mech. Engr., Cleveland	1932-					
36	Cleveland, Ohio	U. S. Lake Survey	--					
37	East Lake, Ohio	Cleveland Electric & Illuminating Co., East Lake Plant, C. A. Dauber, Dir. Civil & Mech. Engr., Cleveland	variable see data	1955-	1955-			
38	Willoughby, Ohio	USWB cooperative	53				X	
39	Fairport, Ohio	Water treatment plant E. Thomas, Supt. (Columbus)	1936-					

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
31	see remarks			X	X	X	X	X	X	Mg	4 plants, with intakes: Div. Ave.: 4 mi. (36) Baldwin: 4 mi. (28) Nottingham: 3.5 mi. (40) Clague Rd. (under const.) 2.5 mi. (35)
32											
33											
34											
35	see remarks	X									intake is "very short" dredged chan.
36										lake level (cont.)	
37	see remarks	1953-									intake is 1000 ft channel dredged to 18 ft depth
38											
39	1000 (12)			X	X	X	X	X	X	Cl	

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
40	Fairport, Ohio	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
41	Painesville, Ohio	Water treatment plant E. W. Russell, Supt. (Columbus)	1914-					
42	Painesville, Ohio	Diamond Alkali Co., R. E. Frey, Asst. Works Mgr.	1945-					
43	Painesville, Ohio	USWB cooperative	9			X	X	
44	Ashtabula, Ohio	Water treatment plant F. J. Hull, Chemist (Columbus)	1909-					
45	Ashtabula, Ohio	Cleveland Elec. & Illum. Co., Ashtabula Plt., C. A. Dauber, Dir. Civil & Mech. Engr., Cleveland	1930-					
46	Ashtabula, Ohio	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
47	Conneaut, Ohio	Water treatment plant W. V. Kantola, Supt. (Columbus)	1900-					
48	Conneaut, Ohio	USWB cooperative	19				X	
49	Conneaut, Ohio	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
50	Erie, Pennsylvania	Water treatment plant J. D. Johnson, Gen. Supt.	--					

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
40											
41	1914-57: 1000 (8) 1957-: 4000 (16)	X		X	X	X	X	X	X	Cl	
42	3488 (22)	X								HCO_3, Cl, CO_3, Ca, Mg, Na, SiO_2, loss on ignition, total solids	
43											
44	1500 (25)			X	X	X	X	X	X		
45	see remarks	X									intake is 1000 ft channel dredged to 18 ft depth
46											
47	see remarks			X	X	X	X	X	X		present intake in use since 1934: 1500 (16). No info on prev. intk.
48											
49											
50	5200 (22)			X		X		X		color, OCCASIONAL ANALY: Fe, Ca, Mg, Na, NO_3, Cl, chlorinity, total slds.	

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
51	Erie, Pennsylvania	USWB First Order Ap.	6	X	X	X	X	p 15, 1
52	Erie, Pennsylvania	USWB First Order City	79	X	X	X	X	p 15, 1
53	Erie, Pennsylvania	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
54	Erie, Pennsylvania	U. S. Lake Survey	--					
55	Dunkirk, N. Y.	Niagara Mohawk Power Corp. Dunkirk Station P. A. Burt, Supt.	1950-			X	X	
56	Dunkirk, N. Y.	USWB cooperative	5				X	
57	Dunkirk, N. Y.	U. S. Lake Survey	--					
58	Dunkirk, N. Y.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
59	Derby, N. Y.	USWB cooperative	14			X	X	
60	Lackawanna, N. Y.	Erie County Water Auth. H. S. Dewey, Adm. Dir., Ellicott Square Bldg., Buffalo 3, N. Y.	variable see data					
61	Buffalo, N. Y.	USCG Base (6 hrly)	--	X	X	X		p 15, 2a
62	Buffalo, N. Y.	U. S. Lake Survey	--					
63	Port Colborne, Ontario	Canadian Hydrographic Service	--					

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
51											
52											
53											
54										lake level (cont.)	
55	at break-wall (see remarks)	X			X	X	X			conductivity, SO_2, SO_4, Cl, HCO_3, lake level	intake samples entire water column between 8 and 21 feet
56											
57										lake level (cont.)	
58											
59											
60	-- (--)			1926-	1926-	1928-	1926-	1926-	1926-	color, odor, 1928- summer plankton, 1930-	
61											
62										lake level (cont.)	
63										lake level (cont.)	

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
64	Port Dover, Ontario	CMD II	variable see data			(X)	45	
65	Long Point, Ontario	CMD II	variable see data	at least 36	36	(X)	(X)	
66	Clear Creek, Ontario	CMD I	--	X	X	X	X	p 15, 1
67	Port Stanley, Ontario	Canadian Hydrographic Service	--					
68	Wheatley, Ontario	Ont. Dept. Lands & Forests Station Dr. D. V. Anderson, Maple, Ontario	--					
69	Leamington, Ohtario	CMD II	variable see data			(X)	33	
70	Pelee Is., Ontario	CMD II	variable see data			(X)	48	

No.	Intake location (ft)	Hydrographic Data: Water temp. Raw	Water temp. Treated	Alk.	pH	Turb.	Hard.	Bacteria Coli.	Bacteria Total	Other	Remarks
64											
65											
66											
67										lake level (cont.)	
68		X									recording thermograph at station
69											
70											

NIAGARA RIVER (proceeding south to north)

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
1	Grand Is. (Tonawanda), N. Y.	Niagara Mohawk Power Corp., Huntley Station W. G. Godfrey, Supt.	1948-					
2	Slater's Point, Ontario	Canadian Hydrographic Service	--					
3	Conner's Is., N. Y.	U. S. Lake Survey	--					
4	Niagara Falls, N. Y.	U. S. Lake Survey	--					
5	Niagara Falls, N. Y.	Naval Air Station	1943-53	X	X	X	X	p 15, 1
6	Niagara Falls, Ontario	CMD II	--			X	X	
7	Niagara Falls, Ontario	CMD II	--			X	X	
8	Lewiston, N. Y.	USWB cooperative	variable see data			42	37	

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
1	shoreline (27)	X		X	X	X	X			SO_4, Cl; water level from 1933	
2										water level (cont.)	
3										water level (cont.)	
4										water level (cont.)	
5											
6											
7											
8											

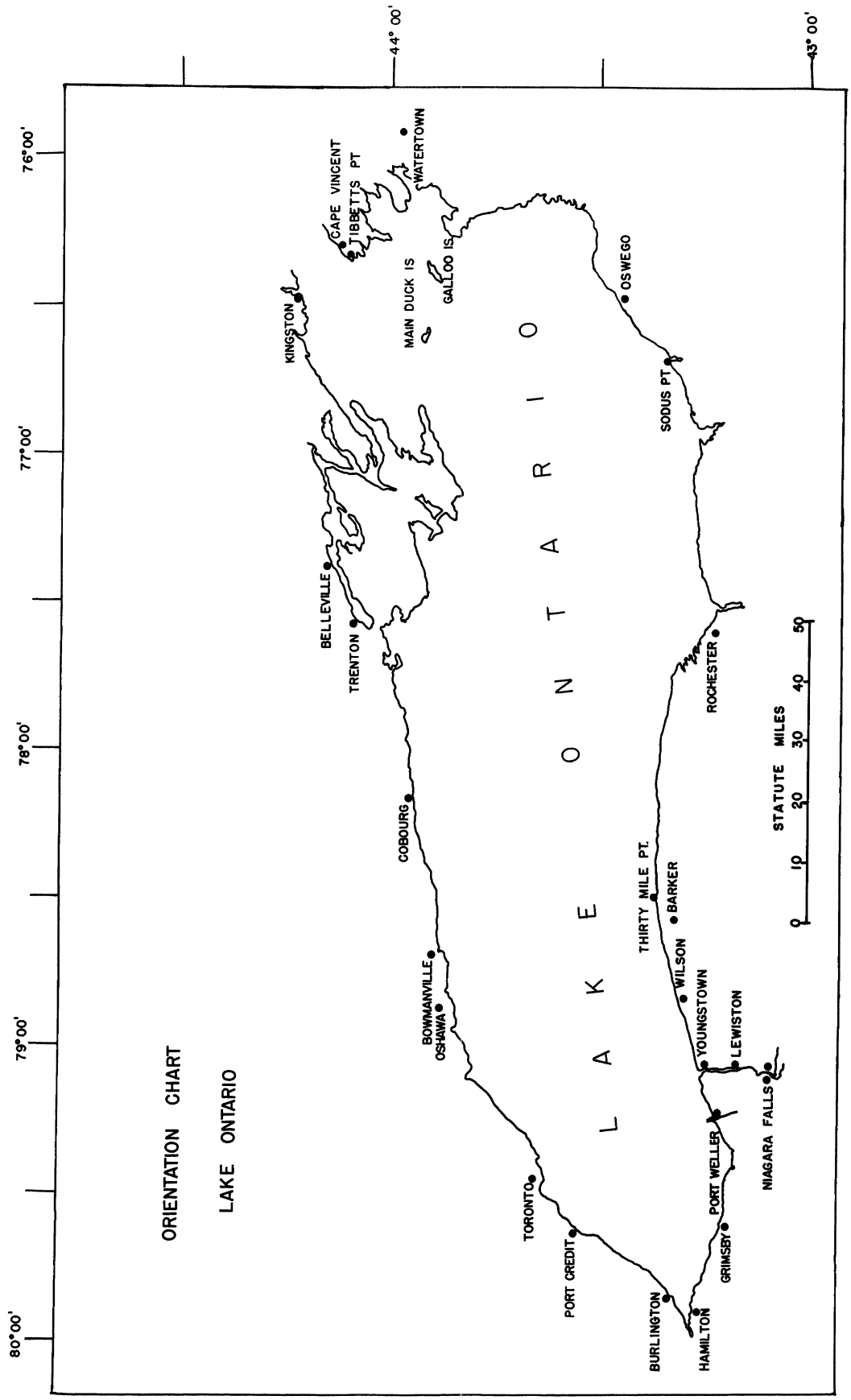

Figure 6. Orientation Chart, Lake Ontario

LAKE ONTARIO (starting at mouth of Niagara River and proceeding counterclockwise)

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
1	Niagara (Youngstown), N. Y.	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
2	Niagara, N. Y.	U. S. Lake Survey	--					
3	Wilson, N. Y.	USWB cooperative	18				X	
4	Barker, N. Y.	USWB cooperative	18				X	
5	Thirty Mile Point (Barker), N. Y.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
6	Rochester, N. Y.	Bureau of Water I. Q. Lacy, Supt.	mid 1955-					
7	Rochester, N. Y.	Eastman Kodak Co. L. C. Faulkenberry, Asst. to the Gen. Mgr.	variable see data					
8	Rochester, N. Y.	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2a
9	Rochester, N. Y.	U. S. Lake Survey	--					
10	Sodus Point, N. Y.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
11	Oswego, N. Y.	Niagara Mohawk Power Co. W. M. Jeram, Supt.	variable see data			1948-		pressure, 1948-
12	Oswego, N. Y.	USCG Lifeboat (6 hrly)	--	X	X	X		p 15, 2b

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
1											
2										lake level (tri-daily)	
3											
4											
5											
6	8300 (50)	X		X	X	X					
7	7800 (55)	1937-			1947-	1952-	1947-			radioactivity, 1952- FOLLOWING CHEM ANAL: volatile and org. matter, silica, iron and alumina oxides, CaO, MgO, sulphuric anhydride, Cl, 1947-.	
8											
9										lake level (cont.)	
10											
11	550 (20)	1948-			1940-		1940-			CO_3, HCO_3, Cl, SO_4, SiO_2, total diss. solids, conductivity, 1940-. Lake level, 1955-.	
12											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
13	Oswego, N. Y.	USWB cooperative	variable see data			104	112	
14	Oswego, N. Y.	U. S. Lake Survey	--					
15	Galloo Is., (Sacketts Hbr.), N. Y.	USCG Lifeboat (4 hrly)	--	X	X	X		p 15, 2b
16	Watertown, N. Y.	USWB Second Order CAA Ap	10	X	X	X	X	p 15, 1
17	Tibbetts Point (Cape Vincent), N. Y.	USCG Light (4 hrly)	--	X	X	X		p 15, 2b
18	Cape Vincent, N. Y.	USCG Light Attendant (4 hrly)	--	X	X	X		p 15, 2b
19	Cape Vincent, N. Y.	U. S. Lake Survey	--					
20	Kingston, Ontario	CMD c	variable see data	at least 36	at least 36	(X)	(X)	sunshine, 68
21	Kingston, Ontario	CMD II	--			X	X	
22	Kingston, Ontario	CMD II	--			X	X	
23	Kingston, Ontario	Canadian Hydrographic Service	--					
24	Main Duck Is., Ontario	CMD c	--	at least 14	at least 14			(weather)

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
13											
14										lake level (cont.)	
15											
16											
17											
18											
19										lake level (cont.)	
20											
21											
22											
23										lake level (cont.)	
24											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
25	Belleville, Ontario	CMD II	variable see data			(X)	56	sunshine, 25
26	Belleville, Ontario	CMD II	--			X	X	
27	Trenton, Ontario	CMD I	17	X	X	X	X	p 15, 1
28	Trenton, Ontario	CMD II	--			X	X	
29	Cobourg, Ontario	CMD II		at least 32	at least 32	(X)	(X)	
30	Cobourg, Ontario	Canadian Hydrographic Service	--					
31	Bowmanville, Ontario	CMD II	--			X	X	
32	Oshawa, Ontario	CMD II	--			X	X	
33	Toronto, Ontario	Water treatment plant D. P. Scott, Deputy Comm. of Works	variable see data	ca 1948-				
34	Toronto, Ontario	Hydro-Elec. Power Comm. of Ontario, R. L. Hearn Generating Station, E. D. Holdup, Plant Supt.	variable see data					
35	Toronto, Ontario	West Hill CMD III	--				X	
36	Toronto, Ontario	Scarborough CMD III	--				X	

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
25											
26											
27											
28											
29											
30										lake level (cont.)	
31											
32											
33	before 1918: 3800 (35 1918-pres: 3800 (69)	1936-		1912-	1925-	1913-	1912-17 1922-23 1931	1912-	1914-	plankton, 1922- nitrogen, Cl, diss. O_2 (period uncertain) lake level, 1912-	
34	see remarks	1952-		1955-	1955-		1955-			conductivity, 1955-	
35											
36											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
37	Toronto, Ontario	Birchcliffe CMD III	--				X	
38	Toronto, Ontario	Admiral Road CMD III	--				X	
39	Toronto, Ontario	Balmy Beach CMD III	--				X	
40	Toronto, Ontario	Hyde Park CMD III	--				X	
41	Toronto, Ontario	Highland CMD II	--			X	X	
42	Toronto, Ontario	Newtonbrook CMD II	--			X	X	
43	Toronto, Ontario	CMD I	variable see data	at least 36	36	117	117	sunshine, 72 p 15, 1
44	Toronto, Ontario	Canadian Hydrographic Service	--					
45	Port Credit, Ontario	CMD II	--			X	X	
46	Burlington, Ontario	CMD II	--			X	X	
47	Hamilton, Ontario	Water treatment plant D. H. Matheson, Dir. of Laboratories	variable see data	1957-	1957-	1951-	(X) (gauges op. by City Engrs. Dept.)	
48	Hamilton, Ontario	CMD III (Gage Park)	--				X	
49	Hamilton, Ontario	CMD II (Hamilton)	--			(X)	58	

No.	Intake location (ft)	Hydrographic Data									Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
37											
38											
39											
40											
41											
42											
43											
44										lake level (cont.)	
45											
46											
47	TWO IN-TAKES 2200 (30) 3000 (30)	1934-		1933-	1933-	1934-	1933-	1933-	1934-	chem, phys, biol. work on Burlington Bay at intervals since 1935 lake level, 1952-	
48											
49											

No.	Location	Agency and Contact	Period of Record	Meteorological Data				
				Wind Dir.	Wind Speed	Air Temp.	Pcpn.	Other
50	Hamilton, Ontario	CMD I	--	X	X	X	X	p 15, 1
51	Grimsby, Ontario	CMD II	--			X	X	
52	Grimsby, Ontario	CMD II	--			X	X	
53	Port Weller, Ontario	Canadian Hydrographic Service	--					

No.	Intake location (ft)	Hydrographic Data								Remarks
		Water temp.		Alk.	pH	Turb.	Hard.	Bacteria		Other	
		Raw	Treated					Coli.	Total		
50											
51											
52											
53										lake level (cont.)	

H. Non-tabulated Data

Information relating to river discharge has not been included in the tabulations. Discharge figures for major streams and rivers tributary to the Great Lakes are obtained from gaugings in both the United States and Canada. In the United States, the responsible agency is the U. S. Geological Survey. Records pertinent to the Great Lakes basin are published yearly in the publication Surface Water Supply of the St. Lawrence River Basin.

In Canada, discharge records are obtained by the Canada Department of Northern Affairs and National Resources, Water Resources Branch. Records are published yearly in Water Resources Papers, which are very similar to those issued by the U. S. Geological Survey.

Both of the above publications are generally two to three years in arrears. More recent data, if desired, are available from individual U. S. Geological Survey offices in the United States, or from the Department of Northern Affairs and National Resources, Water Resources Branch, Ottawa, Ontario.

There are several sources of meteorological data that are not shown in Table 1. Principally, these are data collected by commercial vessels operating on the Lakes. These have not been listed in Table 1 since the data are obtained in varying quantities and locations during the year.

There are approximately 37 commercial lake vessels operated by United States companies and about half that many Canadian commercial vessels that make meteorological measurements when operating more than four miles from shore. These data are transmitted by radio to collection agencies in Canada and the United States for use by marine meteorological personnel and for dissemination over meteorological communications networks.

In addition, there is a smaller number of research and other special purpose vessels which take meteorological data at whatever time they may be conducting operations. This group is comprised of fisheries investigations vessels, U. S. Lake Survey vessels such as the "Williams", the paper mill cruiser operated in northeastern Lake Superior by Colin A. MacMillan of the Marathon Paper Company, and the U. S. Coast Guard cutter "Mackinac." The latter vessel makes six-hourly reports to the U. S. Weather Bureau at Cleveland, Ohio, whenever operating farther than four miles from shore.

II. Table 2

Table 2 lists all meteorological data sources that were inland from the sources listed in Table 1. An inland source was defined to be suitable for inclusion in Table 2 if it was more than two miles from the nearest Lake shoreline. As was indicated earlier, an irregular area surrounding the Lakes was specified to be important as far as the meteorological effects on the Lakes are concerned. This "area of influence" was selected as the drainage basin of the Great Lakes. The basin has been determined by the U. S. Lakes Survey (see Fig. 7, p. 112).

All data sources in the drainage basin (or watershed) of the Lakes, that could be ascertained by the project, are listed. Tabulations are made geographically by state and province, but alphabetically by stations under each province and state. Accordingly, the geographical coordinates of inland stations are shown in degrees and minutes of arc. The type of data source is indicated in the second column; abbreviations have the following meanings: FO - USWB First Order; SO - USWB Second Order; Co - USWB Cooperative; I - CMD Class I; II, III, and c - CMD Classes II, III, and c, respectively; and R - research facility. Some locations have more than one First Order station. Usually one is located at an airport; hence the abbreviation Ap is used in the tabulations. If the installation is in the city, City is used, and if the facility is military, the following are used: NAS for Naval Air Stations, and AFB for Air Force Bases. The letters CAA and USCG refer to Civil Aeronautics Administration and U. S. Coast Guard facilities, respectively.

With respect to future use of the material compiled in Tables 1 and 2, project personnel adjudged that data sources in close juxtaposition to the watershed boundary, but outside it, should be included in the tabulation. This procedure was justified on the grounds that meteorological events (precipitation, for example), although occurring outside the basin would, nevertheless, be representative of conditions in the immediate vicinity of the basin boundary. The number and locations of extra-basin stations were arbitrarily selected. Here again, the stations outside the watershed used by the U. S. Lake Survey in computation of precipitation regimes for lake level studies were used as a basic group. In addition to these, several First Order and Class I stations were included even though they were located somewhat farther distant than most from the basin boundary. All stations outside the boundary are indicated in Table 2 by an asterisk preceding the location name.

The same system for indicating length of record and parameters measured is used here that was employed in Table 1; that is, the numbers appearing in the columns to the right of the location specifications are years of record. Where it is known that an element is measured but the length of record is not known, "X" appears in the space. All parameters taken that are not specified in the table may be determined by consulting the reference given in the last column to the right.

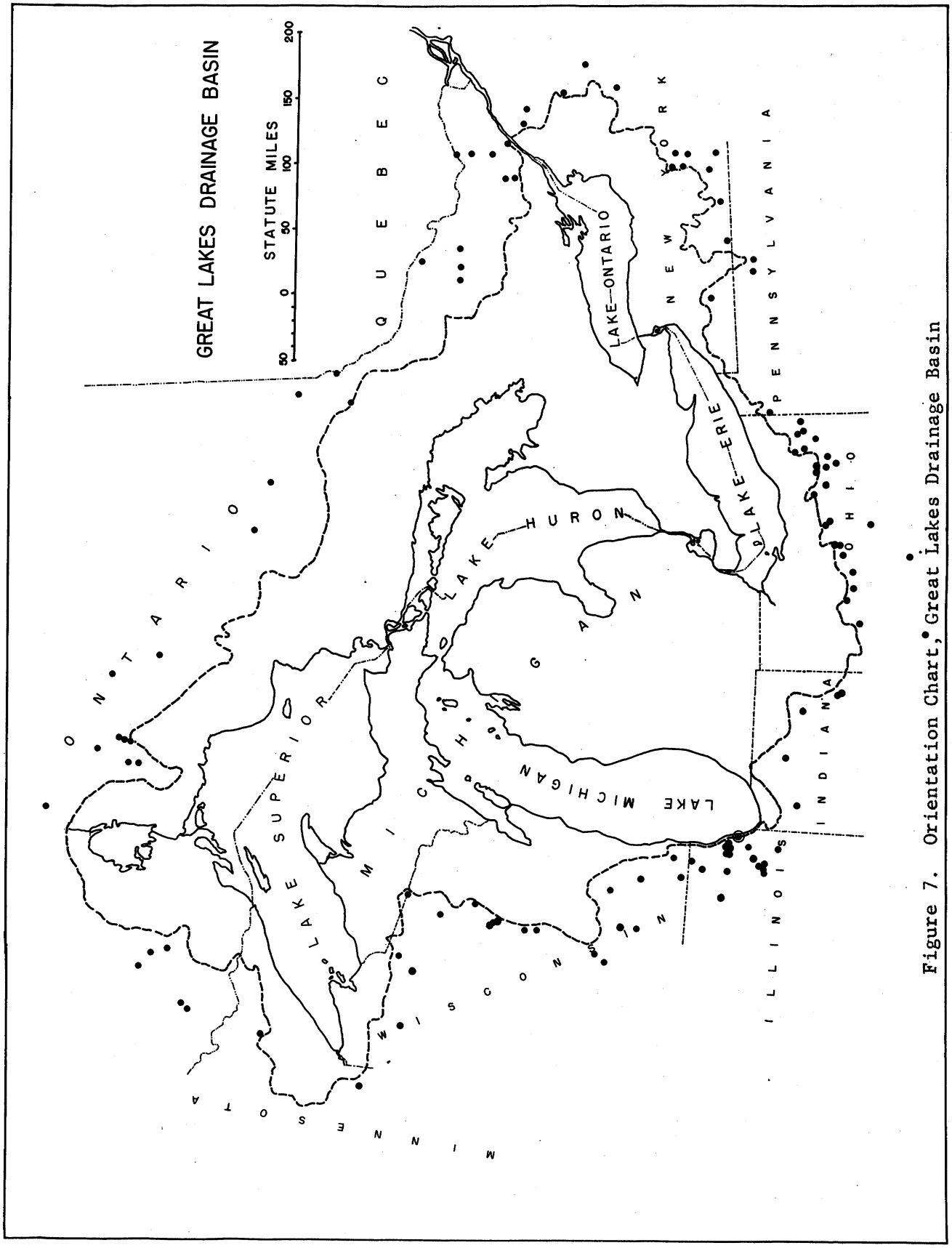

Figure 7. Orientation Chart, Great Lakes Drainage Basin

Table 2. Inland Data Sources

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		MINNESOTA										
1	Co	*Babbitt	47	41	91	55	39	38	39			
2	Co	Brimson	47	16	91	52	--		X			
3	Co	Cloquet Exp. For.	48	42	94	18	48	48	48			
4	FO	Duluth Airport	46	50	92	11	18	18	18	18	18	p 15, 1:(18)
5	Co	Gunflint Lake	48	05	90	42	8		8			
6	Co	Hibbing Power Substation	47	27	92	57	--		X			
7	Co	Holyoke	46	28	92	23	16		16			
8	Co	Isabella 1 mi. W	47	37	91	22	1	1	1			
9	Co	Island Lake Reservoir	46	59	92	14	--		X			
10	Co	Mahoning Mine	47	28	92	59	38	37	38			
11	Co	Meadowlands 2 mi. SSW	47	03	92	45	49	48	49			
12	Co	*Moose Lake 1 mi. SE	46	27	92	45	37	35	37			
13	Co	*Moose Lake Ranger Station	46	27	92	46	30		30			
14	Co	Virginia OMIC Lab.	47	32	92	32	65	65	65			
15	Co	Wales 2 mi. E	47	13	91	43	15		15			
16	Co	Whiteface Reservoir	47	17	92	11	--		X			
		WISCONSIN										
1	Co	*Antigo	45	09	89	09	65	65	65			
2	Co	Appleton	44	15	88	23	55	55	55			
3	Co	Berlin	43	58	88	57	18		18			
4	Co	Bowler	44	52	88	59	21		21			
5	Co	Breakwater	45	50	88	15	37		37			
6	Co	Brillion	44	11	88	04	35		35			
7	Co	Brule Ranger Sta.	46	32	91	35	28		28			
8	Co	Brule Island	45	57	88	13	37	23	37			
9	Co	*Burnett	43	30	88	42	56	56	56			
10	Co	Chilton Sewage Plant	44	02	88	09	32	32	32			
11	Co	Clintonville	44	37	88	45	18	6	18			
12	Co	*Coddington 1 mi. E	44	22	89	32	38	38	38			
13	Co	Crivitz High Falls	45	17	88	12	48	48	48			
14	Co	Dalton	43	39	89	12	14	14	14			
15	Co	Drummond	46	20	91	15	16		16			
16	Co	Eldurado 1 mi. SE	43	48	88	37	20	20	20			
17	Co	*Flambeau Reservoir	46	04	90	14	33		33			
18	Co	Fond du Lac	43	47	88	27	73	73	73			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref;yrs)
		WISCONSIN cont.										
19	Co	Germantown 2 mi. W	43	13	88	09	15	15	15			
20	FO	Green Bay Airport	44	29	88	08	72	72	72	72	72	p 15, 1:(72)
21	Co	Gurney	46	28	90	30	6	6	6			
22	Co	Hancock Exp. Farm	44	07	89	32	67	67	67			
23	Co	*Hayward Ranger Station	46	00	91	29	27		27			
24	Co	Lac Vieux Desert	46	08	89	08	14		14			
25	Co	*Lake Geneva	42	36	88	26	14	14	14			
26	Co	Laona 4 mi. SSW	45	30	88	42	29	28	29			
27	Co	Lily	45	19	88	51	17		17			
28	Co	Longlake Dam	45	54	89	08	51	51	51			
29	FO	*Madison Airport	43	08	89	20	19	19	19	19	19	p 15, 1:(19)
30	FO	*Madison City	43	05	89	24	90	90	90	90	90	p 15, 1:(90)
31	FO	*Madison Truax AFB	43	18	89	21	--	X	X	X	X	p 15, 1:(X)
32	Co	Mellen 2 mi. N	46	21	90	37	33	33	33			
33	Co	Mercer Ranger Sta.	46	10	90	04	25		25			
34	FO	Milwaukee Ap.	42	57	87	54	31	31	31	31	31	p 15, 1:(31)
35	Co	Montello	43	48	89	19	63	51	63			
36	Co	New London	44	23	88	44	63	63	63			
37	Co	*Oconomowoc 1 mi. SW	43	06	88	31	20	20	20			
38	Co	Oshkosh	44	03	88	32	70	70	70			
39	SO	*Park Falls	45	56	90	27	48	48	48	X	X	p 15, 1:(X)
40	Co	Peshtigo	45	04	87	44	13		13			
41	Co	*Phelps Deerskin Dam	46	03	89	02	49		49			
42	Co	Pine River 3 mi. NE	44	11	89	02	7	7	7			
43	Co	Plymouth	43	45	87	59	49	49	49			
44	Co	Portage	43	32	89	27	70	66	70			
45	Co	Rest Lake	46	08	89	53	49	49	49			
46	Co	*Rhinelander	45	38	89	25	57	54	57			
47	Co	Ripon 5 mi. NE	43	52	88	45	--		X			
48	Co	Rosholt Collins	44	36	89	20	18	X	18			
49	Co	Shawano	44	47	88	37	63	63	63			
50	Co	Solon Springs	46	21	91	49	53	53	53			
51	Co	South Pelican	45	32	89	12	14		14			
52	Co	*Stevens Point	44	30	89	34	66	66	66			
53	Co	Summit Lake Ranger Station	45	23	89	12	19		19			
54	Co	Townsend	45	20	88	35	14	14	14			
55	Co	*Union Grove	42	42	88	03	18		18			
56	Co	Waupaca	44	22	89	05	64	63	64			
57	Co	*Wausau	44	59	89	39	14		14			
58	SO	*Wausau CAA Ap.	44	55	89	37	64	64	64	X	X	p 15, 1:(X)
59	Co	*Wausau Old P.O.	44	57	89	38	25	25	25			
60	Co	Wausaukee	45	23	87	57	26		26			
61	Co	West Allis	43	01	87	59	7	7	7			
62	Co	West Bend	43	25	88	11	45	45	45			
63	Co	*Wisconsin Dells	43	38	89	47	36	36	36			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:rys)
		ILLINOIS										
1	Co	*Antioch	42	29	88	06	38	38	38			
2	Co	*Arlington Hgts. 4 mi. SSE	42	02	87	58	8		8			
3	Co	*Chicago Calumet Treatment Works	41	40	87	36	21		21			
4	Co	*Chgo Mayfair Pmpg. Station	41	58	87	45	32		32			
5	Co	*Chgo N. Br. Pmpg. Station	41	58	87	42	25		25			
6	Co	*Chgo Roseland Pmpg. Station	41	42	87	38	32		32			
7	Co	*Chgo San. Dist. Disp. Plant	41	50	87	42	27		27			
8	Co	*Chgo Springfield Pmpg. Station	41	55	87	44	32		32			
9	FO	*Chicago Midway Airport	41	47	87	45	30	30	30	30	30	p 15, 1:(30)
10	FO	*Chicago O'Hare Airport	42	00	87	53	--	X	X	X	X	p 15, 1:(X)
11	Co	*Elgin	42	02	88	17	51		51			
12	FO	*Glenview NAS	42	05	87	49	15	15	15	15	15	p 15, 1·(X)
13	Co	*Joliet Brandon Rd.	41	30	88	06	67		67			
14	SO	*Joliet CAA Ap.	41	36	88	05	--	X	X	X	X	p 15, 1:(X)
15	Co	*Joliet	41	32	88	05	17	16	17			
16	R	*Lemont Argonne National Lab.	41	40	88	00	10	10	10	10	10	radiation, micrometeorological measurements (10)
17	Co	*McHenry	42	21	88	16	19		19			
18	Co	*McHenry 2 mi. S	42	19	88	15	17		17			
19	Co	*Peotone	41	20	87	48	18		18			
20	Co	*Wheaton College	41	52	88	06	30	X	30			
21	Co	*Skokie	42	02	87	45	4	4	4			
22	Co	*Skokie N. Side Treatment Works	42	01	87	43	--		X			
		INDIANA										
1	Co	Angola	41	38	85	00	60	60	60			
2	Co	Berne	40	40	84	57	48	48	48			
3	Co	*Bluffton	40	44	85	11	62		62			
4	Co	*Bluffton Sewage Plant	40	45	85	11	18		18			
5	Co	*Bluffton Water Works	40	44	85	10	10	X	10			
6	Co	*Columbia City	41	09	85	29	56	21	56			
7	Co	*Columbia City 1 mi. S	41	08	85	29	18		18			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		INDIANA cont.										
8	Co	Decatur	40	51	84	56	27		27			
9	Co	Elkhart	41	41	85	58	8		8			
10	Co	Ft. Wayne Disposal Plant	41	06	85	07	13		13			
11	FO	Ft. Wayne Airport	41	00	85	12	47	47	47	47	47	p 15, 1:(47)
12	Co	Fremont	41	44	84	56	9		9			
13	SO	Goshen CAA Airport	41	32	85	48	18	X	18	X	X	p 15, 1:(X)
14	Co	Goshen College	41	34	85	50	44	44	44			
15	Co	Hobart	41	32	87	15	39	39	39			
16	Co	Kendallville	41	27	85	15	12	12	12			
17	Co	Kendallville	41	26	85	16	18		18			
18	Co	Lagrange	41	39	85	25	18		18			
19	Co	La Porte	41	36	86	43	64	61	64			
20	Co	Monroeville 3 mi. ENE	40	59	84	49	18		18			
21	Co	*Plymouth Power Substation	41	20	86	20	54	53	54			
22	FO	South Bend Airport	41	42	86	19	71	65	71	65	65	p 15, 1:(65)
23	Co	Valparaiso Water Works	41	31	87	02	59	58	59	X		evaporation (X)
24	Co	Waterloo	41	25	85	02	21	19	21			
25	Co	Waterloo Highway Garage	41	26	85	01	18		18			
26	Co	*Wheatfield	41	11	87	04	41	41	41			
		MICHIGAN										
1	Co	Adrian	41	54	84	02	81	81	81			
2	Co	Alberta Ford Forestry Court	46	39	88	29	1	1	1			
3	Co	Albion Rice Creek Station	42	17	84	46	49		49			
4	Co	Allegan Sewage Pl.	42	32	85	51	70	70	70			
5	Co	Alma	43	23	84	40	72	72	72			
6	Co	Ann Arbor Univ. Sta.	42	17	83	44	79	79	79	1		suns., press. (2)
7	Co	Atlanta 3 mi. ENE	45	01	84	06	32	32	32			
8	Co	Bad Axe	43	48	83	01	34	34	34			
9	Co	Baldwin St. Forest	43	54	85	51	31	31	31			
10	SO	Battle Creek Ap.	42	18	85	14	75	75	75	X	X	p 15, 1:(X)
11	Co	Beavertown Pwr. Pl.	43	53	84	29	11		11			
12	Co	Beechwood 7 mi. WNW	46	11	88	53	--	X	X			
13	Co	Bellaire Hydro. Plant	44	59	85	12	13		13			
14	Co	Bergland Hydro. Plant	46	35	89	33	35	26	35			
15	Co	Big Rapids Water Works	43	42	85	29	63	63	63			
16	Co	Bloomingdale	42	23	85	57	--	X	X			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		MICHIGAN cont.										
17	Co	Boyne Falls St. Nursery	45	13	84	48	--	X	X			
18	Co	Burnside 1 mi. E	43	12	83	03	16		16			
19	Co	Cadillac Water Works	44	15	85	24	50	50	50			
20	Co	Caro State Hosp.	43	27	83	24	31	31	31			
21	Co	Casnovia 1 mi. N	43	15	85	48	16		16			
22	Co	Champion Van Riper Park	46	31	87	59	--	X	X			
23	Co	Charlotte	42	32	84	50	55	55	55			
24	Co	Chatham Exp. Farm	46	21	86	56	58	55	58			
25	Co	Coldwater St. Sch	41	57	85	00	68	68	68			
26	Co	Coldwater Sewage Treatment Plant	41	56	85	01	--		X			
27	Co	Crystal Falls 6 mi. NE	46	10	88	14	16		16			
28	Co	Dearborn	42	18	83	14	6	6	6	6		evaporation (6)
29	FO	Detroit City Ap.	42	24	83	00	88	88	88	88	88	p 15, 1:(88)
30	FO	Detroit Wayne Co. Airport	42	13	83	19	5				5	ceiling, visibility (5)
31	FO	Detroit Willow Run Airport	42	14	83	32	8	8	8	8	8	p 15, 1:(8)
32	R	Detroit Int'l Joint Comm. Res.	42	28	83	14	3	3				lapse rate to 870 ft (3)
33	Co	Dowagiac	41	59	86	07	5	5	5			
34	Co	East Jordan	45	10	85	07	33	33	33	33	33	
35	Co	East Lansing Exp. Farm	42	42	84	28	--	X	X	X		evaporation (X)
36	FO	East Lansing	42	44	84	29	48	48	48	48	48	p 15, 1:(48)
37	Co	East Lansing Hort. Farm	42	43	84	28	1	1	1	1		evaporation (1)
38	Co	Eaton Rapids	42	31	84	39	39		39			
39	Co	Eau Claire 4 mi. NE	42	01	86	15	35	35	35			
40	Co	Edmore	43	24	85	02	5		5			
41	Co	Evart	43	54	85	16	7	7	7			
42	Co	Ewen	46	32	89	16	16		16			
43	Co	Fife Lake 2 mi. S	44	33	85	21	40	40	40			
44	FO	Flint Airport	42	58	83	44	70	70	70	21	21	p 15, 1:(21)
45	Co	Freesoil 4 mi. SW	44	04	86	17	16		16			
46	Co	Gaylord Cons. Dpt.	45	02	84	41	49	39	49			
47	Co	Germfask Wildlife Refuge	46	17	85	57	19	19	19	X		evaporation (X)
48	SO	Gladwin CAA Ap.	43	59	84	29	54	54	54	X	X	p 15, 1:(X)
49	Co	Glennie Alcona Dam	44	56	85	55	11		11			
50	Co	Grand Haven Fire Dept.	44	34	83	48	88	88	88			
51	Co	Grand Ledge	42	45	84	46	41		41			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref·yrs)
		MICHIGAN cont.										
52	FO	Grand Rapids Ap.	42	54	85	40	109	109	104	109	109	p 15, 1:(98)
53	Co	Grayling Military Reservation	44	38	84	47	69	69	69			
54	Co	Greenville	43	11	85	15	46	46	46			
55	Co	Gull Lake Exp. Farm	42	24	85	23	30	30	30			
56	Co	Gwinn	46	17	87	27	--		X			
57	Co	Hale Five Channels Dam	44	28	83	41	46	46	46			
58	Co	Harrison	44	01	84	48	52		52			
59	Co	Hart	43	42	86	22	69	69	69			
60	Co	Hastings Fisher.	42	39	85	18	66	66	66			
61	Co	Hesperia	43	34	86	02	22	13	22			
62	Co	Higgins Lake	44	31	84	45	58	58	58			
63	Co	Hillsdale	41	55	84	38	71	62	71			
64	Co	Holland	42	47	86	07	54	54	54			
65	SO	Houghton CAA Ap.	47	10	88	30	6	6	6	X	X	p 15, 1:(X)
66	R	Houghton Univ. of Michigan res.	47	14	88	29	1	1	1	1		snow depth (1); radiation, humd. and press. (1)
67	R	Houghton U.S. Army Sig. Corps	47	12	88	30	5	5	5	5	5	min. and max. temp., hum., (5)
68	Co	Houghton Lake 3 mi. NW	44	20	84	49	44	44	44			
69	Co	Howell Sewage Pl.	42	36	83	56	53		53			
70	Co	Howell 7 mi. NE	42	42	83	53	9		9			
71	Co	Hubbard Lake Dam	44	51	83	36	--		X			
72	Co	Interlochen State Park	44	38	85	46	16		16			
73	Co	Ionia Gas Plant	42	59	85	04	28	28	28			
74	Co	Iron Mtn. Water Works	45	50	88	04	59	59	59			
75	Co	Ironwood	46	27	90	10	57	57	57			
76	Co	Ishpeming	46	29	87	39	60	60	60			
77	SO	Jackson CAA Ap.	42	16	84	28	62	62	62	X	X	p 15, 1:(X)
78	Co	Jackson 3 mi. N	42	17	84	24	18		18			
79	Co	Kalamazoo Power Plant	42	18	85	34	18		18			
80	Co	Kalamazoo State Hospital	42	17	85	36	83	83	83			
81	Co	Kalkaska	44	44	85	10	19		19			
82	Co	Kent City 2 mi. SW	43	12	85	46	39		39			
83	Co	Kenton U.S. For.	46	29	88	53	18	18	18			
84	FO	Kinross AFB	46	15	84	28	5	5	5	X	X	p 15, 1:(X)
85	Co	Lapeer	43	03	83	20	--	X	15			
86	Co	Lowell 5 mi. NW	42	59	85	25	44		44			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		MICHIGAN cont.										
87	Co	Lupton	44	26	84	02	8		8			
88	Co	Lupton 1 mi. SW	44	25	84	02	7	7	7	7		evaporation (7)
89	Co	Millington 3 mi. SW	43	14	83	34	57		57			
90	Co	Mio Hydro. Plant	44	40	84	08	55	55	55			
91	Co	Montague	43	25	86	22	8	8	8			
92	Co	Montague 2 mi. N	43	27	86	21	16		16			
93	Co	Mt. Pleasant Col.	43	36	84	47	58	58	58			
94	Co	Newaygo Croton Dam	43	27	85	40	51	51	51			
95	Co	Newberry State Hospital	46	20	85	30	60	60	60			
96	Co	Niles	41	51	86	16	2		2			
97	FO	Oscoda AFB	44	28	83	22	--	X	X	X	X	p 15, 1:(X)
98	Co	Onaway Black L. Forest	45	25	84	14	15		15			
99	Co	Owosso Swg. Plant	43	01	84	11	63	63	63			
100	Co	Paw Paw 2 mi. E	42	13	85	51	38	38	38			
101	SO	Pelston CAA Ap.	45	34	84	48	17	17	17	X	X	p 15, 1:(X)
102	Co	Pontiac	42	39	83	18	71	71	66			
103	Co	Rexton	46	10	85	15	6	6	6			
104	Co	Rock	46	04	87	10	18		18			
105	Co	Romeo 1 mi. N	42	49	83	01	24		24			
106	Co	Roscommon Forest Exp. Station	44	28	84	35	--		X			
107	Co	Rose City	44	26	84	07	8		8			
108	Co	Saginaw Center Radio Station	43	29	84	02	3	3	3			
109	SO	Saginaw-Midland-Bay City CAA Ap.	43	32	84	05	62	62	62	X	X	p 15, 1:(X)
110	Co	St. Charles	43	18	84	08	17	6	17			
111	Co	St. Johns 5 mi. NNW	43	04	84	35	38	38	35			
112	Co	Sandusky	43	25	82	50	40	40	40			
113	Co	Scottville 1 mi. NE	43	58	86	16	34		34			
114	Co	Sebewaing 3 mi.. E	43	44	83	23	17		17			
115	Co	Spalding	43	43	83	27	5		5			
116	Co	Stambaugh	46	05	88	38	63	63	63			
117	Co	Standish 2 mi. S	43	57	83	58	25	25	25			
118	Co	Stanton	43	17	85	04	3		3			
119	Co	Stephenson 5 mi. W	45	24	87	43	--	X	19			
120	Co	Steuben 2 mi. WNW	46	12	86	30	19		19			
121	Co	Suttons Bay 4 mi. NW	45	01	85	42	19		19			
122	Co	Thompsonville	44	31	85	56	19		19			
123	Co	Three Rivers	41	56	85	38	62	62	62			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		MICHIGAN cont.										
124	Co	Trout Lake 2 mi. ESE	46	11	84	59	--		X			
125	Co	Vanderbilt Trout Station	45	10	84	27	46	46	46			
126	Co	Wakefield	45	29	89	55	16		16			
127	Co	Watersmeet Fish Hatchery	46	18	89	05	20	20	20			
128	Co	Wellston Tippey Dam	44	15	85	57	38		38			
129	Co	West Branch State Forest	44	20	84	17	56		56			
130	Co	Williamston 1 mi. NE	42	41	84	16	22		22			
131	Co	Willis 1 mi. NE	42	05	83	35	29	29	29			
132	Co	Yale	43	08	82	48	32		32			
		OHIO										
1	FO	*Akron-Canton Ap.	40	55	81	26	11	11	11	11	11	p 15, 1:(11)
2	FO	*Akron Municipal Airport	41	02	81	27	30	30	30	25	25	p 15, 1:(25)
3	Co	*Akron Swg. Wks.	41	09	81	34	1		1			
4	Co	*APCO Ravenna Arsenal	41	10	81	05	11	11	11			
5	Co	*Ashland 2 mi. ENE	40	54	82	18	49		49			
6	Co	*Ashland 3 mi. NW	40	53	82	22	58	56	58			
7	Co	Ashtabula	41	51	80	48	8	8	8			
8	Co	Botzum Swg. Plant	41	09	81	34	18		18			
9	Co	Bowling Green Sewage Plant	41	23	83	38	77	64	77			
10	Co	Bucyrus Swg. Pl.	40	48	82	58	65	63	65			
11	Co	Burton	41	29	81	09	9		9			
12	Co	*Canton Reposi-tory	40	48	81	23	6	6	6			
13	Co	*Canton Hwy. Dpt.	40	48	81	22	19		19			
14	Co	Chardon	41	35	81	12	13	13	13			
15	Co	*Charles Mill Dam	40	44	82	22	18	18	18	X		evaporation (X)
16	Co	*Chippewa Lake	41	05	81	54	63	63	63			
17	FO	Cleveland Airport	41	24	81	51	32	32	32	32	32	p 15, 1:(32)
18	FO	Cleveland City	41	30	81	42	88	88	88	88	88	p 15, 1:(88)
19	Co	*Columbus Ohio State Univ.	40	00	83	01	74	74	74	X		evaporation (X)
20	Co	*Columbus Sullivant Ave.	39	56	83	05	8	8	8			
21	Co	*Columbus Valley Cross	39	56	82	57	42	42	42			
22	FO	*Columbus Airport	40	00	82	53	28	28	28	28	28	p 15, 1:(28)

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		OHIO cont.										
23	FO	*Columbus City	39	58	83	00	79	79	79	79	79	p 15, 1:(79)
24	Co	*Dayton	39	45	84	10	23	23	23	X		evaporation (X)
25	FO	*Dayton Airport	39	54	84	12	28	28	28	28	28	p 15, 1:(28)
26	Co	Defiance	41	17	84	23	54	48	54			
27	Co	Defiance Pwr. Pl.	41	17	84	28	17		17			
28	Co	Dorset 2 mi. E	41	41	80	38	2	2	2			
29	Co	Edgerton	41	27	84	44	17		17			
30	Co	*Ellsworth	41	01	80	51	43		43			
31	Co	Elyria 3 mi. E	41	23	82	04	10	10	10			
32	SO	Findlay CAA Ap.	41	01	83	40	17	X	17	X	X	p 15, 1:(X)
33	Co	Findlay Swg. Pl.	41	03	83	40	69	69	69			
34	Co	Fremont	41	20	83	07	18	6	18			
35	Co	*Galion Wtr. Wks.	40	43	82	47	12		12			
36	Co	*Hiram	41	19	81	09	78	74	78			
37	Co	Hoytville 2 mi. NE	41	12	83	47	7	7	7			
38	Co	Kenton Ohio Pwr. Co.	40	38	83	37	17		17			
39	Co	*Kenton 2 mi. W	40	39	83	39	66	65	66			
40	Co	*Lakeview 3 mi. NE	40	32	83	54	42		42			
41	Co	*La Rue	40	34	83	23	40		40			
42	Co	Lima Swg. Plant	40	43	84	07	59	56	59			
43	Co	Lima Water Works	40	45	84	05	17		17			
44	R	Lima Standard Oil Co.	40	44	84	08	--	X	X	X		
45	Co	*Louisville	40	50	81	16	12		12			
46	Co	Lyons High School	41	42	84	04	18		18			
47	Co	*Mansfield 6 mi. W	40	45	82	38	59	39	59			
48	SO	Mansfield CAA Ap.	40	47	82	32	--	X	X	X	X	p 15, 1:(X)
49	Co	*Marion Wtr. Wks.	40	36	83	10	15	X	15			
50	Co	*Marshallville	40	54	81	43	10		10			
51	Co	Montpelier	41	35	84	36	67	56	67			
52	Co	Napoleon	41	23	84	07	72	64	72			
53	Co	Norwalk	41	15	82	37	74	64	74			
54	Co	Oberlin	41	17	82	13	82	74	82			
55	Co	Painesville Hwy. Department	41	43	81	13	19		19			
56	Co	Pandora 2 mi. NE	40	58	83	51	17	17	17			
57	Co	Paulding	41	08	84	35	68	63	68			
58	Co	Plymouth	41	00	82	40	25	25	25			
59	Co	Rockford 5 mi. WNW	40	42	84	45	4		4			
60	Co	Rockford 0.3 mi. W	40	38	84	48	19		19			
61	Co	St. Marys 2 mi. W	40	32	84	25	20		20			
62	Co	St. Marys Water Works	40	32	84	24	21		21			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		OHIO cont.										
63	Co	S. New Lyme 1 mi. W	41	35	80	46	12		12			
64	Co	Tiffin	41	07	83	10	77	72	77			
65	FO	Toledo Exp. Ap.	41	36	83	48	4	4	4	4	4	p 15, 1:(4)
66	Co	Toledo Blade	41	39	83	32	7	7	7			
67	FO	Toledo City	41	40	83	34	85	85	85	85	85	p 15, 1:(85)
68	Co	Upper Sandusky	40	50	83	17	75	74	75			
69	Co	Upper Sandusky Water Works	40	49	83	17	18		18			
70	Co	Van Wert	40	52	84	35	44	43	44			
71	Co	*Warren	41	15	80	51	69	65	69			
72	Co	*Warren Ohio Edison	41	13	80	48	24		24			
73	Co	Wauseon Sewage PL	41	33	84	08	88	88	86			
74	FO	*Youngstown Ap.	41	16	80	40	87	87	16	16	16	p 15, 1:(16)
		PENNSYLVANIA										
1	Co	*Coudersport 3 mi. NW	41	49	78	03	3	3	3			
2	Co	*Coudersport 7 mi. E	41	46	77	53	12		12			
3	Co	*Linesville	41	41	80	31	41	7	41			
4	Co	North East 2 mi. SE	42	12	79	49	9		9			
5	Co	Springboro	41	48	80	23	4	4	4			
		NEW YORK										
1	Co	Albion 3 mi. NE	43	16	78	08	21	21	21			
2	Co	Alexandria Bay	44	20	75	55	27	23	27			
3	Co	Alfred	42	15	77	47	66	62	66			
4	Co	Angelica	42	18	78	02	74	74	74			
5	Co	Arcade	42	32	78	25	36	7	36			
6	Co	Arnot Lodge	42	16	76	38	4		4			
7	Co	Arnot SCS	42	14	76	37	11		11			
8	Co	Auburn Wtr. Wks.	42	54	76	32	95	95	89	X		
9	Co	Aurora Research Farm	42	44	76	39	2	2	2	2		evaporation (2)
10	Co	Avon	42	55	77	45	63		63			
11	Co	Baldwinsville	43	09	76	20	60	21	60			
12	Co	Batavia	43	00	78	11	28	28	28			
13	Co	Beaver Falls	43	53	75	26	25		25			
14	Co	Big Moose 3 mi. E	43	49	74	52	28		28			
15	FO	*Binghamton	42	13	75	59	8	8	8	8	8	p 15, 1:(8)
16	Co	*Binghamton	42	06	75	55	69	69	69			
17	Co	Black R. 1 mi. SW	44	00	75	49	19		19			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		NEW YORK cont.										
18	Co	Boonville 2 mi. N	43	31	75	21	36		36			
19	Co	Boonville 2 mi. SSW	43	27	75	21	10	10	10	X		evaporation (X)
20	Co	Brewerton Lock 23	43	14	76	12	27		27			
21	Co	Bristol Springs	42	43	77	22	27		27			
22	Co	Brockport 2 mi. NW	43	15	77	58	9	9	9			
23	FO	Buffalo Airport	42	56	78	44	108	108	102	88	88	p 15, 1:(88)
24	Co	Burdett 1 mi. NE	42	25	76	50	27		27			
25	Co	Camden	43	20	75	44	13		13			
26	Co	Canandaigua 3 mi. S	42	51	77	17	27	25	27			
27	Co	Canaserage	42	28	77	47	5		5			
28	Co	Canastota 1 mi. SW	43	04	75	45	27		27			
29	Co	*Candor	42	14	76	21	15		15			
30	Co	*Canton	44	36	75	10	97	97	92			
31	Co	Cayuga Lock 1	42	57	76	44	32		32			
32	Co	Churchville	43	06	77	53	5		5			
33	Co	*Cincinnatus	42	32	75	54	22		22			
34	Co	Clyde Lock 26	43	04	76	50	41		41			
35	Co	Colden	42	40	78	41	--	X	X			soil temp.(X)
36	Co	*Colton 3 mi. N	44	35	74	57	25		25			
37	Co	Constantia	43	15	76	00	7		7			
38	Co	*Cortland	42	36	76	11	98	98	81			
39	Co	Dansville	42	34	77	42	41	38	41			
40	Co	Delta	43	17	75	27	40		40			
41	Co	Eagle Bay	43	46	74	49	6		6			
42	Co	Eagle Falls	43	54	75	11	34		34			
43	Co	*East Homer 1	42	42	76	07	19		19			
44	Co	*East Homer 2	42	43	76	07	10		10			
45	Co	Elma	42	51	78	39	17	17	17	6		evaporation (6)
46	Co	*Elmira	42	05	76	48	80	79	80			
47	SO	Elmira CAA Airport	42	10	76	54	19	11	19	X	X	p 15, 1:(X)
48	Co	Forestport	43	26	75	13	25		25			
49	Co	*Franklinville	42	21	78	27	10	10	10			
50	Co	Fredonia	42	26	79	22	72	72	63			
51	Co	Freeville 2 mi. NE	42	32	76	19	19		19			
52	Co	Fulton	43	19	76	25	33		33			
53	Co	Garbutt	43	01	77	47	5		5			
54	Co	Geneva Exp. Sta.	42	53	77	00	70	89	70			
55	FO	Geneva Sampson AFB	42	50	77	00	--	X	X	X	X	p 15, 1:(X)
56	Co	Gouverneur	44	20	75	28	53	22	53			
57	Co	Gowanda St. Hosp.	42	29	78	56	14	13	14			
58	Co	Gravesville 2 mi. N	43	16	75	07	9	9	9			humidity (X)
59	Co	Hammondsport 1 mi S	42	24	77	13	5		5			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		NEW YORK cont.										
60	Co	Hemlock	42	47	77	37	61	61	61			
61	Co	Highmarket	43	35	75	31	35		35			
62	Co	Highmarket 1 mi. SE	43	35	75	30	19		19			
63	Co	Hilton	43	17	77	47	14	14	14			
64	Co	Hinckley	43	18	75	07	41		41			
65	Co	*Hoffmeister	43	23	74	43	53		53			
66	Co	Honeoye Falls	42	57	77	35	5		5			
67	Co	Hooker	43	41	75	45	27		27			
68	Co	Hornell Almond Dam	42	21	77	42	5		5			
69	Co	*Indian Lake 2 mi. SW	43	45	74	17	60	59	60			
70	Co	Ithaca Cornell Univ.	42	27	76	28	41	27	40	41		evap. (41), sunshine (X), pressure (X)
71	Co	*Lincklaen	42	41	75	53	6		6			
72	Co	Linden	42	52	78	10	40		40			
73	Co	Locke 4 mi. W	42	40	76	28	27		27			
74	Co	Lockport 2 mi. NE	43	11	78	39	73	67	73			
75	Co	Lowville	43	48	75	29	98	93	98			
76	Co	Lyons Falls	43	37	75	22	45		45			
77	Co	Macedon	43	04	77	18	40		40			
78	Co	Marcellus SCS	42	59	76	23	19		19			
79	Co	Mays Pt. Lock 25	43	00	76	46	40		40			
80	Co	Mt. Morris 2 mi. W	42	44	77	54	9	9	9			
81	Co	Newark	43	03	77	06	39		39			
82	Co	Newark Valley	42	13	76	12	4		4			
83	Co	New London Lock 22	43	12	75	37	39		39			
84	Co	Ogdensburg Hosp. 3 mi. NE	44	44	75	27	68	68	66			
85	Co	Old Forge 2 mi. SW	43	42	75	00	12	11	12			
86	Co	Ovid	42	40	76	50	27		27			
87	Co	Penn Yan	42	39	77	04	107	53	107			
88	Co	Prattsburg 2 mi. NW	42	32	77	18	18		18			
89	Co	Pulaski	43	34	76	08	--	X	X			
90	FO	Rochester Airport	43	07	77	20	130	129	130	88	88	p 15, 1:(88)
91	FO	Rome Griffiss AFB	43	14	75	25	16	16	16	16	16	p 15, 1:(16)
92	Co	Rushford 3 mi. SW	42	22	78	18	5		5			
93	Co	Sabattis 3 mi. NE	44	07	74	40	26		26			
94	Co	Sabattis Whitney Park	44	03	74	38	3	3	3			
95	Co	Saranac Lake	44	19	74	07	29	29	29			
96	Co	Scio	42	10	77	59	30		30			
97	Co	Sherman	42	10	79	36	8		8			
98	Co	Skaneateles	42	57	76	26	65		65			
99	Co	Sodus 2 mi. SSW	43	13	77	04	30	30	30			
100	Co	S. Edwards 1 mi. E	44	16	75	12	32		32			

No.	Class	Location	Lat N deg	min	Long W deg	min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		NEW YORK cont.										
101	Co	S. Wales Emery Pk.	42	43	78	36	28	28	28			
102	Co	Stafford	42	59	78	05	28	28	28			
103	Co	Stillwater Reserv.	43	53	75	02	38	32	38			
104	FO	Syracuse Airport	43	07	76	07	71	71	62	62	62	p 15, 1:(62)
105	Co	Theresa	44	13	75	47	18		18			
106	Co	*Troupsburg 4 mi. NE	42	04	77	29	18		18			
107	Co	Truxton	42	43	76	02	19		19			
108	SO	Utica CAA Airport	43	09	75	23	19	X	19	X	X	p 15, 1:(X)
109	Co	Wales	42	45	78	31	17		17			
110	Co	Wanakena Ranger School	44	09	74	54	49	48	49			
111	Co	Warsaw 5 mi. SW	42	41	78	12	7	7	7			
112	Co	Waterloo	42	54	76	52	36		36			
113	Co	Watertown	43	58	75	52	69	67	69			
114	Co	Wellsville	42	07	77	57	3		3			
115	Co	Westfield 2 mi. SW	42	17	79	37	43	38	43			
116	Co	Whitesville	42	02	77	46	5		5			
117	Co	Wiscoy	42	30	78	05	19	19	19			
118	Co	Wolcott	43	14	46	49	20		20			
		ONTARIO										
1	II	Agincourt	43	47	79	16	--	X	X	50		
2	III	Aldershot	43	18	79	54	--		X			
3	II	Aldershot (HEPC)	43	18	79	52	--	X	X			
4	II	Algonquin Park	45	35	78	33	--	31	31			
5	III	Alliston	44	08	79	58	--		X			
6	III	Alloa	43	43	79	52	--		X			
7	II	Alton	43	51	80	05	--	51	51			
8	II	Angus	44	19	79	52	--	X	X			
9	II	Apsley	44	46	78	05	--	X	X			
10	I	Armstrong	50	18	88	55	--	24	24	94	X	p 15, 1:(X)
11	II	*Atikokan	48	44	91	38	--	34	34			
12	II	Barrie	44	24	79	41	--	56	56			
13	II	*Bear Island	46	59	80	05	--	X	X			
14	II	Beatrice	45	08	76	16	--	63	66			
15	II	Beaverton	44	25	79	09	--	X	X			
16	II	Beeton	44	06	79	47	--	X	X			
17	III	Benny	46	31	81	38	--		X			
18	II	Bingham Chute	46	06	79	24	--	X	X			
19	II	Biscotasing	47	17	82	07	--	34	34			
20	II	Black Sturgeon Lk.	49	20	88	50	--	X	X			
21	II	Bradford	44	06	79	30	--	X	X			
22	II	Brampton	43	41	79	46	--	X	X			
23	II	Brantford	43	08	80	16	--	62	62			
24	II	Brockville	44	33	75	40	--	33	X			
25	III	Broddytown	43	37	79	36	--		X			
26	II	Brucefield	43	33	81	33	--	45	45			

No.	Class	Location	Lat N deg	min	Long W deg	min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		ONTARIO cont.										
27	III	Burnhamthorpe	43	37	79	36	--		X			
28	II	Caledonia	43	06	79	57	--	X	X			
29	II	Cameron Falls	49	09	88	21	--	25	25			
30	III	Campbellford	44	18	77	48	--		X			
31	II	Canboro	42	59	79	35	--	X	X			
32	II	Caramat	49	37	86	09	--	X	X			
33	I	Centralia	43	18	81	31	--	X	X	X	X	p 15, 1:(X)
34	I	*Chalk River	46	00	77	26	--	20	21	50	X	sunshine (21); p 15, 1:(X)
35	II	Chapleau	47	50	83	25	--	35	35			
36	II	Chatham	42	23	82	12	--	59	71			sunshine (21)
37	II	Chatham (CFCO)	42	23	82	12	--	X	X			
38	III	Chatsworth	44	24	80	54	--		X			
39	II	Clarkson	43	33	79	37	--	X	X			
40	I	Clear Creek	42	35	80	34	--	X	X	X	X	p 15, 1:(X)
41	III	Clifford	43	57	80	58	--		X			
42	II	Coe Hill	44	53	77	50	--	X	X			
43	II	Coldwater	44	42	79	40	--	X	X			
44	II	Coniston	46	28	80	49	--	X	X			
45	II	Crystal Falls	46	27	79	55	--	X	X			
46	II	Delhi	42	52	80	32	--	X	X			sunshine (21)
47	III	Dog Lake Dam	48	05	89	38	--		X			
48	III	*Domville	44	47	75	32	--		X			
49	III	Dona	48	30	89	31	--		X			
50	III	Doon	43	24	80	27	--		X			
51	II	Dorset	45	15	78	53	--	X	X			
52	III	Dunnville	42	55	79	42	--		X			
53	II	Durham	44	13	80	48	--	X	X			
54	I	*Earlton	47	42	79	51	--	16	16	60	X	p 15, 1:(X)
55	III	Eugenia	44	18	80	33	--		34			
56	III	Fenelon Falls	44	23	78	44	--		X			
57	II	Fergus	43	48	80	20	--	X	X			
58	II	*Foleyet	48	15	82	26	--	X	X			
59	II	Forest	43	06	82	00	--	X	X			
60	II	Franz	48	27	84	24	--	30	30			
61	II	Galt	43	22	80	19	--	X	X			
62	II	Georgetown	43	38	79	55	--	44	73			
63	II	*Geraldton	49	42	86	53	--	X	X			
64	III	*Geraldton (HEPC)	49	46	86	57	--		X			
65	II	Gilmour	44	51	77	56	--	X	X			
66	II	Glencoe	42	42	81	42	--	X	X			
67	II	Gooderham	44	55	78	23	--	X	X			
68	III	Gore's Landing	44	08	78	13	--		X			
69	I	*Graham	49	16	90	35	--	X	X	X	X	p 15, 1:(X)
70	III	Green River	43	54	79	11	--		X			
71	III	Grey Co. Forest	44	07	80	48	--		X			
72	III	Grimsby (Rock Chapel)	43	09	79	42	--		X			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		ONTARIO cont.										
73	II	Guelph	43	33	80	16	--	55	55	105		sunshine (34)
74	III	Hagersville	43	00	80	03	--		X			
75	II	Haliburton	45	01	78	28	--	57	57			
76	II	Haliburton (2)	45	03	78	29	--	X	X			
77	II	Harrow	42	02	82	53	--	31	31			sunshine (32)
78	II	Helen Mine	48	04	84	45	--	X	X			
79	II	Holstein	44	03	80	46	--	X	X			
80	III	Hopeville	44	05	80	34	--		X			
81	III	Hornby	43	33	79	50	--		X			
82	II	*Hornepayne	49	14	84	51	--	31	31			
83	II	Huntsville	45	19	79	15	--	41	41			
84	III	Ilderton	43	07	81	23	--		X			
85	II	Jarvis Lake	49	15	87	49	--	X	X			
86	II	Kakabeka Falls	48	24	89	37	--	41	41			
87	II	Kemptville	45	02	75	39	--	X	X			
88	III	*Kenogami Dam	49	55	86	28	--		X			
89	II	Killala	49	09	86	28	--	X	X			
90	I	*Killaloe	45	34	77	24	--	16	16	50	X	p 15, 1:(X)
91	II	Kohler	42	56	79	52	--	X	X			
92	II	Lafontaine	44	45	80	05	--	X	X			
93	III	Lakeport	43	59	77	55	--		X			
94	II	Lindsay	44	20	78	44	--	68	68			sunshine (68)
95	II	Listowel	43	45	80	58	--	X	X			
96	I	London	43	02	81	09	--	65	65	52	X	p 15, 1:(X)
97	II	*Longlac	49	45	86	30	--	29	29			
98	II	*Longlac (P & P)	49	45	86	30	--	X	X			
99	II	Long Lake Control Dam	49	05	87	03	--	X	X			
100	II	Long Point	42	33	80	03	--	X	X	45		
101	II	Lucan	43	11	81	24	--	X	X			
102	II	Lucknow	43	58	81	31	--	58	58			
103	II	Macdiarmid	49	26	88	09	--	X	X			
104	II	McVittie	46	17	80	52	--	X	X			
105	II	*Madawaska	45	30	77	59	--	X	X			
106	II	Magnetawan	45	40	79	38	--	X	X			
107	I	Malton	43	41	79	38	--	17	17	69	X	humidity (X); p 15, 1:(X)
108	II	Manitou Falls	49	12	86	06	--	X	X			
109	III	*Mattagami Lake Dam	48	01	81	33	--		X			
110	II	Melville	43	55	80	03	--	X	X			
111	III	Meyersburg	44	17	77	48	--		X			
112	II	Midhurst	44	27	79	44	--	X	X			
113	III	Mildmay	44	03	81	07	--		X			
114	III	Miller Lake For.	45	05	81	25	--		X			
115	II	Millgrove	43	21	79	56	--	X	X			
116	III	Mink Lake	47	01	82	04	--		X			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		ONTARIO cont.										
117	II	Mitchell	43	28	81	11	--	X	X			
118	II	Montreal Falls	47	15	84	24	--	X	X			
119	II	*Montreal River	47	07	79	29	--	37	37			
120	III	*Moose Lake	48	50	91	36	--		X			
121	III	Morriston	43	28	80	07	--		X			
122	I	Muskoka	44	58	79	19	--	16	16	52	X	p 15, 1:(X)
123	I	*Nakina	50	11	86	42	--	16	16	57	X	humidity (X); p 15, 1:(X)
124	II	North Bay	46	19	79	28	--	28	34			
125	I	North Bay (A)	46	22	79	25	--	16	16	60	X	p 15, 1:(X)
126	II	Oak Ridges	43	58	79	28	--	30	30	90		sunshine (29)
127	II	Oil City	42	55	82	02	--	X	X			
128	II	Orillia	44	37	79	24	--	49	49			
129	II	Orono	43	59	78	35	--	X	X			
130	I	*Ottawa (Uplands)	45	20	75	41	--	76	76	72		sunshine (53)
131	II	Oxaline Lake	49	42	87	34	--	X	X			
132	I	*Pagwa	50	02	85	16	--	16	16	52	X	p 15, 1:(X)
133	II	Pays Plat	49	43	87	34	--	X	X			
134	II	Pefferlaw	44	19	79	13	--	X	X			
135	II	Peshu Lake	46	37	83	10	--	X	X			
136	II	Peterboro	44	17	78	19	--	66	71			
137	III	Peterboro (HEPC)	44	20	78	19	--		X			
138	II	Peters Corners	43	17	80	04	--	X	X			
139	III	Petrolia	42	57	82	05	--		X			
140	III	Pine Portage	49	18	88	19	--		X			
141	II	*Port Elmsley	44	53	76	08	--	X	X			
142	II	Portland	44	42	76	12	--	X	X			
143	II	Preston	43	40	80	25	--	X	X			
144	II	*Quorn	49	25	90	05	--	33	33			
145	II	Ragged Rapids	45	01	79	40	--	X	X			
146	III	Ramsay	46	58	82	21	--		X			
147	II	Ranger Lake	46	55	83	30	--	X	X			
148	III	Rayner	46	27	83	23	--		X			
149	III	Red Cedar Lake Dam	46	41	80	01	--		X			
150	II	Redickville	44	13	80	13	--	X	X			
151	III	*Rideau Ferry	44	51	76	09	--		X			
152	II	Ridgetown	42	26	81	55	--	X	X			
153	II	Ridgeville	43	04	79	08	--	X	X			
154	I	*Rockcliffe	45	28	75	38	--	14	14	X	X	p 15, 1:(X)
155	II	Ruel	47	18	81	27	--	33	33			
156	II	St. Catherines	43	09	79	17	--	33	32			sunshine (21)
157	II	St. Catherines (Path. Lab.)	43	10	79	17	--	X	X			
158	III	St. Joachim	42	10	82	38	--		X			
159	II	St. Thomas	42	48	81	11	--	X	X			
160	II	Sand Lake	47	47	84	32	--	X	X			
161	III	Sauble Forest	44	41	81	15	--		X			
162	III	Scotia Junction	45	31	79	17	--		X			
163	II	Simcoe	42	52	80	20	--	32	32			

No.	Class	Location	Lat N deg	Lat N min	Long W deg	Long W min	Per of Rec	Temp Yrs	Pcpn Yrs	Wind Yrs	Wea Yrs	Other (ref:yrs)
		ONTARIO cont.										
164	II	Smithfield	44	05	77	40	--	X	X			
165	II	Smoky Falls	50	04	82	10	--	X	X			
166	III	Snelgrove	43	45	79	50	--		X			
167	II	Stayner	44	28	80	06	--	X	X			
168	I	Stirling	44	19	77	38	--	15	15	55	X	p 15, 1:(X)
169	II	Stratford	43	23	81	00	--	X	X			
170	II	Strathroy	42	58	81	38	--	X	X			
171	I	Sudbury	46	29	80	59	--	27	27	X	X	p 15, 1:(X)
172	III	Talbotville	42	48	81	15	--		X			
173	III	Toronto (Downsview South)	43	43	79	29	--		X			
174	II	Toronto (East York)	43	42	79	20	--	X	X			
175	III	Toronto (Glenview)	43	42	79	27	--		X			
176	II	Toronto (Islington West)	43	39	79	33	--	X	X			
177	III	Toronto (Kingsway)	43	39	79	31	--		X			
178	III	Toronto (Scarlett Road)	43	40	79	30	--		X			
179	II	Toronto (South Leaside)	43	42	79	22	--	X	X			
180	III	Toronto (Wexford)	43	45	79	18	--		X			
181	III	Toronto (Willowdale)	46	47	79	26	--		X			
182	II	Toronto (Wilson Heights)	43	44	79	26	--	X	X			
183	III	Trethewey Falls	44	59	79	17	--		X			
184	II	Turbine	46	23	81	34	--	34	34			sunshine (30)
185	II	Tweed	44	30	77	19	--	X	X			
186	III	Unionville	43	52	79	20	--		X			
187	II	*Upsala	49	03	90	28	--	X	X			
188	II	Uxbridge	44	07	79	06	--	X	X			
189	II	Vineland	43	10	79	19	--	X	X			sunshine (35)
190	II	Walkerton	44	03	81	09	--	33	33	70		
191	II	Wallaceburg	42	35	82	24	--	41	41			
192	III	Wasdells	44	47	79	18	--		X			
193	III	Washago	44	35	79	20	--		X			
194	III	Waterford	42	58	80	17	--		X			
195	II	Waterloo	43	28	80	27	--	X	X			
196	II	Welland	42	59	79	17	--	56	56			
197	I	White River	48	35	85	17	--	62	62	55	X	p 15, 1:(X)
198	I	Windsor	42	17	82	58	--	X	59	18	X	p 15, 1:(X)
199	II	Woodbridge	43	50	79	36	--	X	X			
200	II	Woodslee	42	13	82	42	--	X	X			
201	II	Woodstock	43	08	80	47	--	76	76			sunshine (58)

III. Table 3

The facilities listed in Table 3 are those that were uncovered by the project but which were adjudged to be unsuitable for inclusion in Tables 1 or 2. One of three situations described the reason for deletion. Most of the sources were contacted, but the data recorded by the installations were of such short record or of such a nature that there was no immediate future use deemed possible for it by the investigators. These cases are listed in the first column. In a few cases, data of interest to the project are taken, but for technical reasons, such as intake location or instrument exposure, they were considered unrepresentative. These are shown in the second column. In a few cases the existence of potential data sources was determined, but for a variety of reasons no contact with source authorities was possible. Only 16 cases of this type occurred -- 1.4 per cent of the total of 1177 sources.

Table 3. Unusable Data Sources

Location	Installation	Few or No Data	Data Not Repres.	No Contact
Red Rock, Ont.	St. Lawrence Corp.			X
Port Arthur, Ont.	Abitibi Pulp & Paper Co.			X
Port Arthur, Ont.	Provincial Paper Co.			X
Grand Marais, Ont.	water treatment plant			X
Two Harbors, Minn.	municipal power plant			X
Ontonagon, Mich.	water treatment plant	X		
Eagle River, Mich.	water treatment plant	X		
Eagle Harbor, Mich.	water treatment plant	X		
Copper Harbor, Mich.	water treatment plant	X		
Gay, Mich.	water treatment plant	X		
Pequaming, Mich.	water treatment plant	X		
Sault Ste. Marie, Ont.	Algoma Steel Co.			X
Nahma, Mich.	water treatment plant	X		
Waukegan, Ill.	Commonwealth Edison Co.	X		
Great Lakes NTS	power plant	X		
Winnetka, Ill.	municipal power plant			X
East Chicago, Ind.	water treatment plant			X
Indiana Harbor, Ind.	Youngstown Sheet & Tube Company	X		
Ludington, Mich.	Dow Chemical Co.		X	
Muskegon, Mich.	Consumers Power Co.		X	
Essexville, Mich.	Consumers Power Co.		X	
Traverse City, Mich.	municipal power plant	X		
Alpena, Mich.	Huron Portland Cement Co.			X
East Tawas, Mich.	water treatment plant	X		
Lorain, Ohio	National Tube Co.	X		
Painesville, Ohio	Industrial Rayon Corp.			X
Ashtabula, Ohio	Union Carbide and Carbon Corp.			X
Erie, Penn.	Pennsylvania Elec. Co.	X		
Dunkirk, N. Y.	water treatment plant	X		
Buffalo, N. Y.	water treatment plant	X		
Buffalo, N. Y.	Republic Steel Co.	X		
Wilson, N. Y.	water treatment plant	X		
Newfane, N. Y.	water treatment plant	X		
Barker, N. Y.	water treatment plant	X		
Lyndonville, N. Y.	water treatment plant	X		
Brockport, N Y.	water treatment plant	X		
Hilton, N. Y.	water treatment plant	X		
Williamson, N. Y.	water treatment plant	X		
Sodus Point, N. Y.	water treatment plant	X		
Wolcott, N. Y.	water treatment plant	X		
Oswego, N. Y.	water treatment plant	X		
Sacketts Harbor, N. Y.	water treatment plant	X		
Oshawa, Ont.	General Motors of Canada			X
Oshawa, Ont.	Oshawa Public Utilities			X
Hamilton, Ont.	Steel Co. of Canada			X
(unknown)	Upper Peninsula Generating Co.			X
(unknown)	Produce Terminal Co.			X

5. SUMMARY

The entire Great Lakes drainage basin was reviewed for sources of hydrographic and meteorological data, potentially applicable to studies of Great Lakes hydrography and fisheries. Agencies which were found to obtain either or both of these types of data were: water treatment plants; power plants; industrial concerns; U. S. Coast Guard; paper mills; Sanitary District Observers; U. S. Weather Bureau First Order, Second Order and Cooperative stations; Canadian Meteorological Division Class I, II, III, and c stations; U. S. Lake Survey; Canadian Hydrographic Service; U. S. Geological Survey; Canadian Department of Northern Affairs and National Resources, Water Resources Branch; independent research installations; and several miscellaneous uncategorized agencies.

Tables 4 and 5 present a summarization of knowledge of data sources appearing in Tables 1, 2, and 3. Table 4, entitled Summary of Knowledge of All Potential Data Sources, indicates the number and per cent of agencies contained within each source type that have usable or unusable data and those agencies with which no contact was possible (no contact). Following the format utilized throughout this report, these agencies have been categorized as either onshore or inland. Entries appearing in the usable column have been derived from Tables 1 and 2. Entries in the unusable column have been derived from the first two columns of Table 3, and entries in the no contact column, from the third column of Table 3.

For example, 97 water treatment plants were located which utilize Great Lakes water. These plants constituted 8.3 per cent of the total potential sources located. Of these, 73 (75 per cent) possessed usable data, 22 (23 per cent) possessed no data of use to the purposes of this investigation, and 2 (2 per cent) could not, for various reasons, be adequately ascertained.

A total of 1177 separate possible data sources were located in the drainage basin. Of the total, slightly less than half (44.2 per cent) are located within two miles of the Lake shores (onshore), whereas 55.8 per cent are more than two miles from the shoreline (inland).

A high percentage of all onshore agencies have proved to possess apparently usable meteorological and/or hydrographic data, namely, 91 per cent; only 6 per cent of the reviewed data is unusable and 3 per cent is for plants with which no contact was established.

The percentage distribution of onshore agencies by type of installation is of interest as shown in Table 4. The Coast Guard, meteorological substations, and water treatment plants all represent, numerically, data sources of the same order of magnitude. The numbers of data to be found in power plants and industries, and from the U. S. Lake Survey and the Canadian Hydrographic Service are each about half of the percentage represented by the aforementioned three source types. Other meteorological sources and the Sanitary District Observers are, in turn, nearly equal and each less than half the percentage of the latter two source types. There are very few paper mills, research, and special organizations that were uncovered as data sources by the project (together about 1 per cent of the total).

Table 4

Summary of Knowledge of All Potential Data Sources

TYPE OF INSTALLATION	USABLE No.	USABLE %	UNUSABLE No.	UNUSABLE %	NO CONTACT No.	NO CONTACT %	TOTAL No.	TOTAL %
ONSHORE								
Water treatment plants	73	75	22	23	2	2	97	8.3
Power plants and industries	34	62	10	18	11	20	55	4.7
U. S. Coast Guard	124	100	0	0	0	0	124	10.5
Paper mills	3	50	0	0	3	50	6	0.5
Sanitary District Observers	21	100	0	0	0	0	21	1.8
U. S. Weather Bureau 1st & 2nd Order, U.S. Naval & Air Force Bases, Canadian Meteorological Division I	24	100	0	0	0	0	24	2.0
U. S. Weather Bureau Cooperatives, Canadian Meteorological Division II, III, c	132	100	0	0	0	0	132	11.2
U. S. Lake Survey, Canadian Hydrographic Service	55	100	0	0	0	0	55	4.7
Other (research, individuals)	6	100	0	0	0	0	6	0.5
TOTAL ONSHORE	472	90.8	32	6.2	16	3.0	520	44.2
INLAND								
U. S. Weather Bureau 1st & 2nd Order, U.S. Naval & Air Force Bases, Canadian Meteorological Division I	67	100	0	0	0	0	67	5.7
U. S. Weather Bureau Cooperatives, Canadian Meteorological Division II, III, c	585	100	0	0	0	0	585	49.7
Research installations	5	100	0	0	0	0	5	0.4
TOTAL INLAND	657	100	0	0	0	0	657	55.8
TOTAL ONSHORE AND INLAND SOURCES	1129	95.9	32	2.7	16	1.4	1177	100.0

The 657 inland sources are, with the exception of five research installations, U. S. Weather Bureau, U. S. Naval Air, U. S. Air Force, or Canadian Meteorological Division stations. Data for all stations are usable, and all except those taken by the research groups are published.

The USWB Cooperatives and CMD Class II, III, and c stations comprise by far the largest single source of data ascertained by the project. This source represents half of the total number of hydrographic and meteorological stations existing within the Great Lakes watershed. Data recorded by these stations, while few in variety, are basic to future studies that may examine applicability of meteorological parameters to hydrographic and fisheries problems.

Table 5, entitled Summary of Knowledge of Usable Data Sources, presents a breakdown of sources from which data of apparent use to studies of Great Lakes hydrography and meteorology are available. Entries in this table have, as in Table 4, been categorized as onshore or inland, and are presented in terms of absolute number and per cent of total for each type agency.

The principal difference between Table 5 and Table 4 is the effect of the 47 water and power plant installations for which there were few usable data or with which no contact was established. These are not accounted for in Table 5 which shows the percentage distribution for usable data sources only. The reduction in numbers is reflected by the drop from 8.3 per cent in Table 4 to 6.5 per cent of the total in Table 5. Power plant and industries percentage took an even greater proportionate drop since 21 of the 55 plants possessed few usable data or else no contact could be established with plant personnel.

The results of this investigation are displayed in Tables 1, 2, and 3. The following data sources are not included in the Tables for reasons given on p. 110:

1. River discharge information obtainable from the U. S. Geological Survey and Canada Department of Northern Affairs and National Resources.
2. Information relating to meteorological observations obtained by lake freighters and other vessels.

Table 1 lists the sources of usable hydrographic and/or meteorological data that are located within two miles of the lake shores.

Table 2 lists the sources of usable meteorological data located more than two miles from the lake shores, but within the confines of the Great Lakes drainage basin. There are certain exceptions, namely, 126 U. S. Weather Bureau and Canadian Meteorological Division weather stations which lie just outside the limits of the drainage basin, but have been included in the compilation to provide more complete coverage in certain areas.

Table 3 lists the potential sources which were investigated and found to possess no usable data. This table also includes those agencies with which suitable liason or contact could not be established.

Table 5

Summary of Knowledge of Usable Data Sources

TYPE OF INSTALLATION	FREQUENCY OF USABLE DATA SOURCES No.	%
ONSHORE		
Water treatment plants	73	6.5
Power plants and industries	34	3.0
U. S. Coast Guard	124	11.0
Paper mills	3	0.3
Sanitary District Observers	21	1.9
U. S. Weather Bureau 1st & 2nd Order, U. S. Naval & Air Force Bases, Canadian Meteorological Division I	24	2.1
U. S. Weather Bureau Cooperatives, Canadian Meteorological Division II, III, c	132	11.7
U. S. Lake Survey, Canadian Hydrographic Service	55	4.9
Other (research, individuals)	6	0.5
TOTAL ONSHORE	472	41.9
INLAND		
U. S. Weather Bureau 1st & 2nd Order, U. S. Naval & Air Force Bases, Canadian Meteorological Division I	67	5.9
U. S. Weather Bureau Cooperatives, Canadian Meteorological Division II, III, c	585	51.8
Research installations	5	0.4
TOTAL INLAND	657	58.1
TOTAL ONSHORE AND INLAND SOURCES	1129	100.0

Figure 8 is a histogram of the information contained in Table 4. The contribution of each type of data source is shown by percentage frequency distribution. The open portion of each bar indicates the percentage of usable sources, and the shaded portions indicate the percentages of unusable and "no contact" sources.

Figure 9, also a histogram, summarizes the percentage of usable, unusable, and no contact sources for (1) the onshore sources, (2) the inland sources, and (3) the total sources for the entire drainage basin.

A bibliography is appended to this report which gives references on the subjects of hydrography and meteorology as they pertain to potentially applicable scientific problems of the Great Lakes.

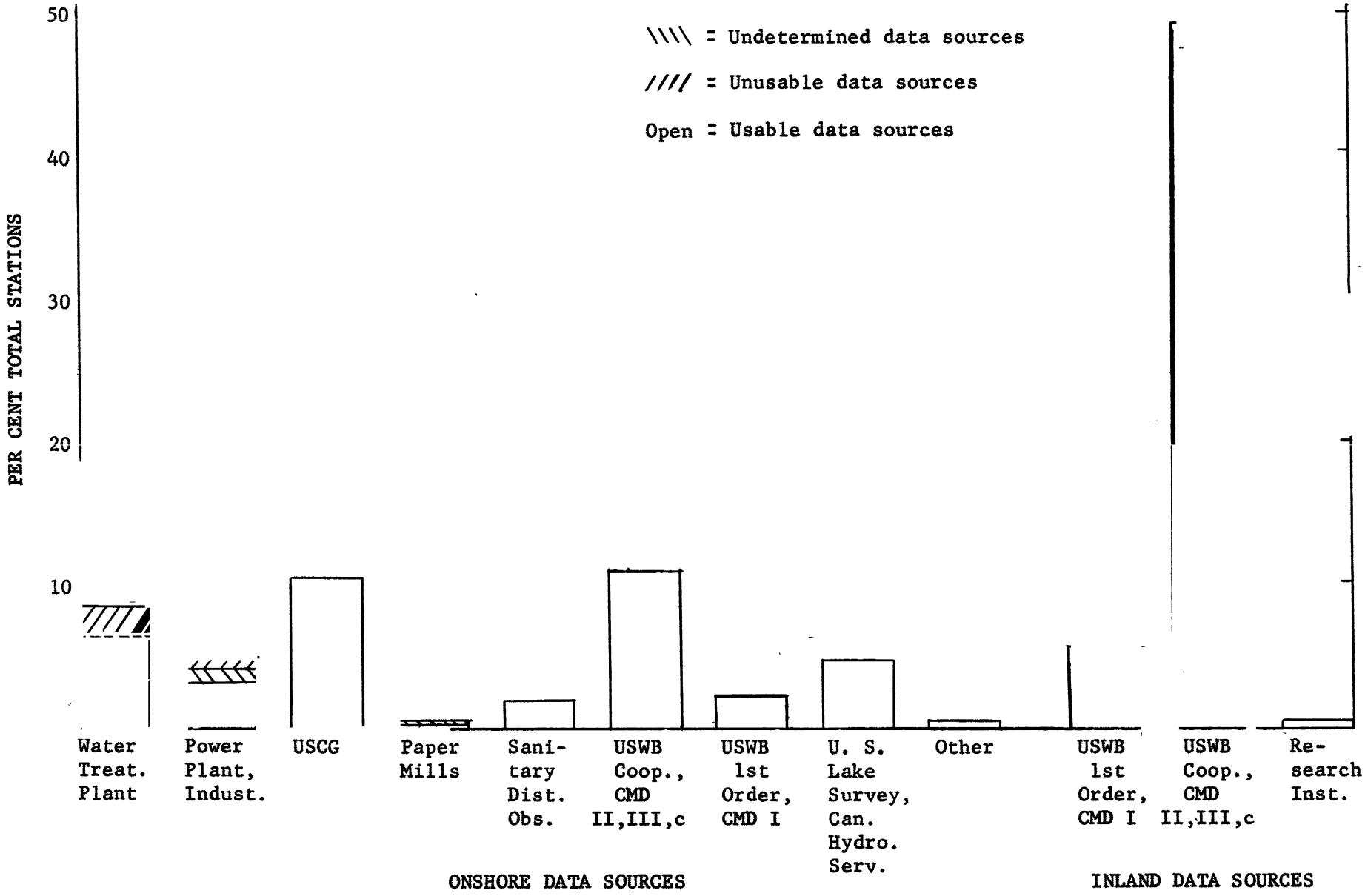

Figure 8. Per cent frequency of all potential data sources.

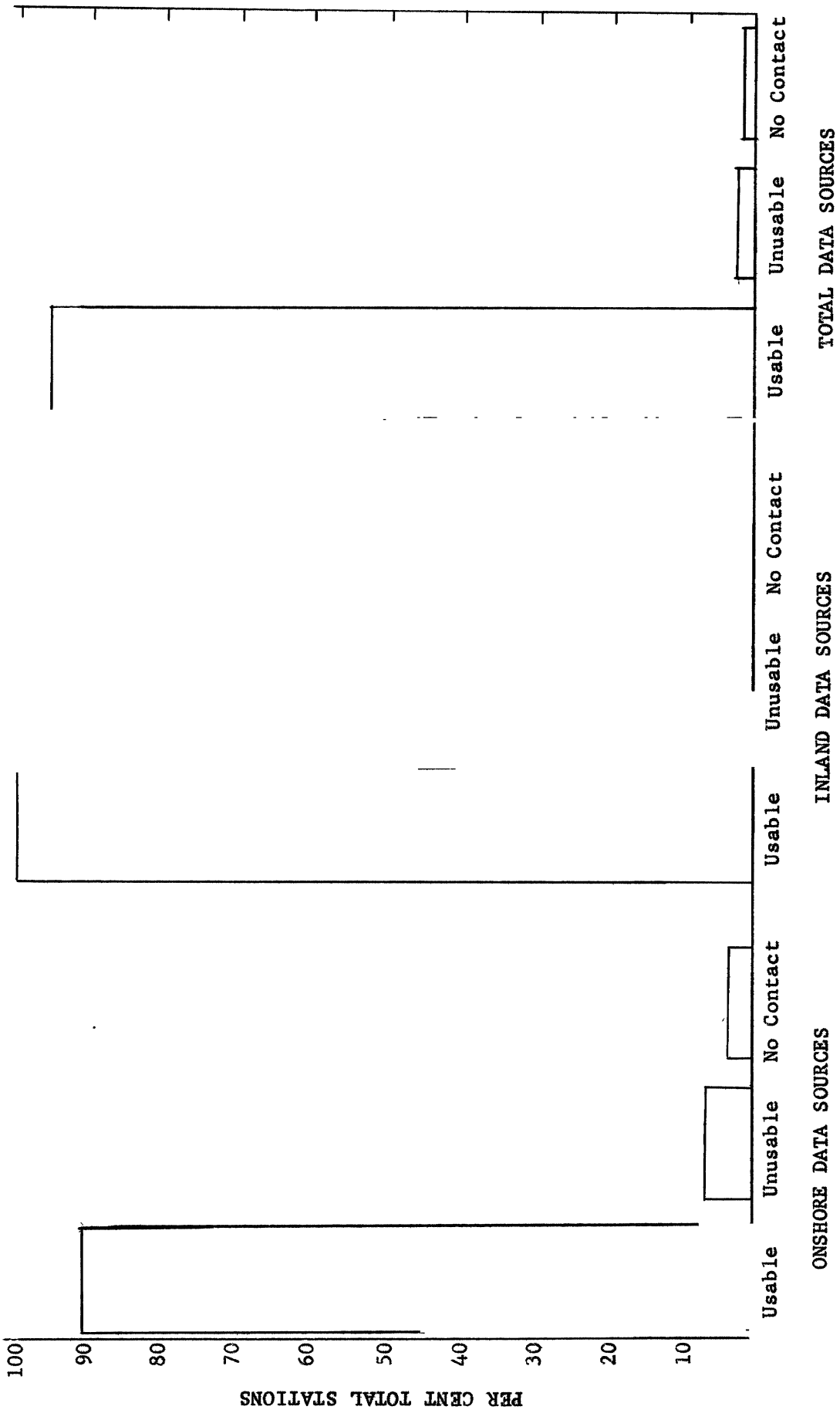

Figure 9. Summary of knowledge of all potential data sources.

Appendix

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